SIEMENS

SC 6002XL Patient Monitor
Field Service Manual

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ADVISORY

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- contain the name of the company performing the work
- describe the changes made
- describe any equipment performance changes.

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Chapter 1: Introduction

1 Introduction

In keeping with the service strategy for the SC6002XL, this service manual provides the necessary information required to service an SC 6002XL patient monitor in the field. The SC 6002XL is both a stationary and a portable monitor designed to monitor patient vital signs (refer to user's guide for monitoring options). For stationary operation near a bedside, the monitor is connected to an AC/DC power adapter or placed on a specially designed docking station attached to a shelf, wall, or rolling stand that securely locks it into place. While on the docking station, the monitor is powered by a CPS or an IDS power supply. When the monitor is detached from a CPS or IDS, it is powered by a lead acid battery or by an optional Lithium ion battery. The monitor is reattached to the AC/DC Power Adapter or placed back on a CPS or IDS to recharge the battery.

1.1 Service Strategy

The monitor has been designed for high reliability, with an estimated MTBF of 50,000 hours (5.7 yrs.) of continuous operation.

Therefore, the service strategy is based on few failures in the field, a clear definition of failure analysis by field service personnel, and a quick repair turnaround. The field repair philosophy is based on the distributed and approved spare parts list. Refer to Appendix A: Replaceable Parts.

This manual is intended to serve as a source of technical information, for qualified field service personnel to use in servicing SC6002XL patient monitor in accordance with the Siemens Service Strategy. Field service is expected to be successful "First-Time Every Time."

1.2 Replaceable Parts

SC 6002XL monitors have several replaceable subassemblies, each of which also has replaceable subassemblies and/or components.

- Front Bezel Subassembly
- Front Panel PC Board
- TFT-LCD Display Subassembly,
- Main Processor Subassembly,
- NBP Subassembly, and
- Rear Housing Subassembly with integrated serial number chip.

Individual "consumable" replaceable parts include the battery, fluorescent backlight, and NBP filters. A complete listing of spare parts is included in Appendix A: Replaceable Parts of this manual. Replacement of components other than those listed in Appendix A should be performed only at Siemens service depots in Danvers, MA, U.S.A. or in Solna, Sweden, where specialized repair and testing equipment can assure product reliability.

1.3 Technical Manual Conventions

The following conventions are employed in this manual:

A NOTE calls attention to items of special interest or provides additional related information about a specific topic:

> Note: Attempting to repair any PC board to the component level may void any warranty, either express or implied.

A Caution indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate property damage. It may also alert against unsafe practices.

Caution

Printed circuit boards in these monitors contain components that are easily damaged by static electricity. Open monitors only in a static-protected environment. Observe proper procedures to prevent damage to the equipment resulting from static discharge.

A Warning indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.

Warning

Do not operate this product in the presence of flammable gasses or liquids. If this device is operated where flammable anesthetics, skin cleansers, or disinfectants are used, the possibility of an explosion cannot be excluded. This product must be operated only in strict conformance with local fire prevention regulations.

2 Product Overview

SC 6002XL Patient Monitors are light-weight, battery-equipped, hand-held or semi-permanently mounted devices for general purpose monitoring of a preconfigured set of physiological parameters. When not connected to a hospital's main ac power, they use a battery with approximately 1¼ hours (3 hrs. for Li option battery) of operating time. A power adapter, CPS/ docking station combination, or IDS, which also charges the battery, can be used to operate the monitor from the hospital's main ac power circuit.

2.1 Monitored Patient Parameters

The SC6002XL monitors the following physiological parameters:

- ECG (three-lead, five-lead, or six-lead pod)
- Respiration
- Pulse Oximetry (SpO_2 and PR)
- Temperature
- NBP
- IBP1, IBP2 (locked option)
- $etCO_2$ via PodComm Port (locked option)
- Arrythmia
- OCRG (locked option)
- Dual Lead S-T Segment Analysis (locked option, ≥VF0 SW required)

2.2 SC 6002XL Monitor Controls

All functions are controlled by a 16-position rotary knob and nine front panel fixed keys - Alarm Silence, Record, Alarm Limits, NBP Start/Stop, All Alarms Off, Zoom, Main Screen, Menu, and ON/OFF. Turning the rotary knob locates different menu items, and pressing the knob in selects the item. Depending on the item selected, pressing the knob in may either bring up another menu or initiate an action. See Section 5. For detailed operating instructions, consult the SC 6002XL Patient Monitor User Guide applicable to the installed software.

2.3 TFT-LCD Display

The SC 6002XL monitor has a 6.5 inch (16.5cm), 3-channel color TFT-LCD display. Waveforms display in Erase Bar mode at 25 ±20% mm/s (except for respiration and $etCO_2$ waveforms which display at 6.25 ±20% mm/s). All displays for a given parameter (label, unit of measure, and waveform) are in the same color. If a waveform is not displayed for a parameter, its label is gray.

2.4 Alarms

Alarm limits can be set either on a user-definable setup table, or automatically based on current parameter values. Three alarm grades, each with a distinct alarm tone, announce alarm situations of varying severity:

- life-threatening (asystole or ventricular fibrillation - red)
- serious (parameter limit alarms - yellow)
- advisory (technical alarms - white)

The message field background and parameter field of the parameter in alarm are displayed in the color associated with the alarm grade as given above.

2.5 Monitor/Software Tracking

Each monitor has a unique ID chip installed in its rear housing for diagnostic and tracking purposes, and un/locking optional software features.

3 Preventative Maintenance

3.1 General

SC 6002XL monitors require replacement of the lead-acid battery (12 months), NBP air intake filter (24 months) and fluorescent bulb (45K - 50K hours).

Siemens recommends that a full functional verification be performed annually. See Chapter 4: Functional Verification and Calibration. Also, some national jurisdictions require that a temperature calibration (see Section 1.8.2 in Chapter 4) and an NBP calibration be performed at least every two years. Refer to Section 3, Calibrating NBP System in Chapter 4 for the NBP calibration procedure.

> Note: Replace the internal manifold filter on the NBP subassembly only if the NBP subassembly should fail characterization.

3.2 Battery

To obtain maximum life from a new lead-acid battery, install the battery into the monitor and run the monitor on battery power for a period of 15 minutes. After the 15 minute period, either plug in the monitor's power adapter or lock the monitor onto a powered docking station and charge the battery, or remove the battery from the monitor and connect the battery to an external charger. (This initial sequence is not needed for Li batteries.)

When in storage or not in use for an extended period of time, lead-acid batteries self-discharge and develop a "float-charge" as a characteristic of the self-discharge process. The "float charge" must be drained off before the battery can be properly charged. If a new battery is immediately placed on a charger, the "float charge" provides an incorrect indication of the battery's charge condition, and the charger may not fully charge the battery.

Between discharges, the lead-acid battery must be recharged as soon as possible. Once charged, it can be stored for [a] 4 months without recharging. Siemens recommends that the battery charge be maintained at >80% to maximize the battery's capacity and cycle life. Starting at a 100% charge level, at room temperature the battery will self-discharge below the acceptable minimum in about 6 months on a shelf and in about 2 months in an unpowered spare monitor.

Warning

Dispose of used batteries in accordance with local regulations governing disposal of hazardous materials.

4 Technical Data

Technical Data included in this Section is as of publication date of this Manual. Changes are reported in User Guide applicable to installed SW.

4.1 General

Table 1-1 General Specifications

Parameter	Specification
Power Requirements	100-250 VAC through AC power adapter
Mains Frequency	50/60 Hz
AC Power Consumption	60 VA AC
Battery Type	Lead-acid: PANASONIC LC-T121R8PU or equivalent Lithium-ion: Siemens Li+ Battery Pack
DC Input	11 - 14 V; 32 W continuous, 49 W peak
Battery Operating Time (means running with NBP measurement every 15 min @ 25°C temperature, no etCO_2 running	Lead-acid: 75 mins Lithium-ion: 180 mins
Battery Recharging Time	Lead-acid: 5 ½ hours, typical Lithium-ion: 8 hours, typical
Battery Charge/Discharge/Charge:	Lithium-ion only (operating as defined above): 2 hours, charging for 2 hours, operating 2 hours
Patient Leakage Current	<10 µA @ 110 V and 60 Hz (per UL 544) <10 µA @ 220 V and 50 Hz (per IEC 601-1)
Chassis Leakage Current with battery eliminator	<100 µA @ 110 V and 60 Hz (per UL 544) <500 µA @ 220 V and 50 Hz (per IEC 601-1)

4.2 Environmental

Table 1-2 Environmental Specifications

Parameter	Environmental Specification
Cooling Method	Convection and cooling chimney (no fan)
Temperature: Operating Storage	 0°C to +40°C (without recorder) -20°C to +50°C
Relative Humidity: Operating Storage	 >30% and <95%, non-condensing >10% and <95% non-condensing
Altitude: Operating Storage	 -381 to +3048 m (-1250 to 10,000 ft.) 525 to 795 mmHg (70.0 to 106 kPa) -381 to 5486 m (-1250 to 18,000 ft.) 375 to 795 mmHg (50.0 to 106 kPa)
Water Resistance	Drip-Proof
Dimensions (H x W x D):	196 x 223 x 134 mm (7.7 x 8.8 x 5.3 in) (w/ rotary knob)

Table 1-2 Environmental Specifications (Continued)

Parameter	Environmental Specification
Weight: SC 6002XL (w/o $etCO_2$) Battery	 3.42 kg (7.54 lb) w/ lead-acid battery 3.22 kg (7.10 lb) w/ lithium-ion battery 2.87 kg (6.32 lb)) w/o battery Lead-acid: 0.55 kg (1.22 lb) Lithium-ion: 0.35 kg (0.78 lb)
Finish: according to Siemens Corporate Design Guidelines	Front: white Rear and Handle: anthracite gray Material: ABS Polycarbonate Blend (injection molded plastic)

4.3 Display

Table 1-3 Display Specifications

Parameter	Specification
Type	Color Thin Film Transistor - Liquid Crystal Display (TFT-LCD)
Size	170 mm (6.7 in) diagonal
Resolution	640 x 480 pixels
Active Viewing Area	132.5 x 99.4 mm
Pixel pitch	0.207 mm x 0.207 mm
Sweep Speeds	fixed 25 mm/s ±20% for ECG, SpO_2, and IBP curves fixed 6.25 mm/s ±20% for Rsp and $etCO_2$ curves
Display Mode	Erase bar (updates waveforms from left to right)

4.4 Outputs

Table 1-4 Output Specifications

Parameter	Specification
QRS Synchronization: Timing: Output Pulse:	 For heart rates from 30 to 250 [1/min], with QRS widths from 40 to 120 msec and QRS amplitudes from 0.5 to 5 mV, a sync pulse is delayed no more than 35 msec from peak of R-wave for each valid QRS complex. +12 V, 100 ms duration
Alarm Output	12 V Open collector output for external alarm indicator
Recorder	UART interface w/ recorder through interface plate or docking station connector
Debug Port	UART interface w/ a PC to retrieve diagnostic information through interface plate or docking station connector
External VGA	Video signals sent to external VGA display for remote viewing of SC6002XL screen. -- not available when Infinity Serial Hub interface plate in use.
Export Protocol	UART interface w/ external devices using proprietary export protocol. -- not available when Infinity Serial Hub interface plate in use.
Network	Serial connection to Infinity Network through Infinity Serial Hub interface plate or docking station connector.

4.5 Connectors

Table 1-5 Connector Specifications

Parameter	Specification
DC Input	Siemens 2-pin power connector
Docking Station	Siemens 28-pin connector to provide Alarm Output, Recorder, Debug Port, Network, External VGA and Power
Memory Card	PCMCIA slot
QRS Sync	Phone jack connector
MultiMed Pod	16-pin shielded female input connector
IBP	7-pin shielded female input connector
NBP Hose	One-hand coupling system
$etCO_2$	7-pin shielded female PodComm connector

Note: For patient parameter specifications, refer to User Guide applicable to installed software version.

5 Monitor Controls

The rotary knob in the lower right corner of the front panel is a pointing and selecting device. Turn the knob to select a screen area or menu item or to change a default value, and press the knob in to confirm your selection and to set a default value. Press Main Screen key to return to the *MAIN* screen.

Note: Instructions in this chapter are intended to provide only a cursory overview of basic monitor controls for accessing and performing service-related functions. Refer to the User Guide for the installed software version for complete operating information.

5.1 Main Screen Key

Pressing the Main Screen key exits the current menu or screen and displays the home screen.

5.2 Menu Key

-- provides access to the Main menu. In general, functions of direct concern to the CSE or Biomed are accessed via Monitor Setup → Biomed on the Main menu. **Password-protected service-related functions are to be performed by only authorized technical personnel.** Use Biomed password (375) to access the following:

- Save Setups - Confirm or Cancel
- Locked Options - four locks into which monitor-specific 2-digit codes must be entered to enable locked options
- Diagnostic Logs
- Units
  - Temperature - °C or °F
  - Pressure - mmHg or kPa
- Service - requires Service password. (The password is given on the Service Setup Instructions for the installed software version.)
  - Update Software
  - Line Frquency - set the frequency equal to the ac mains line according to local conditions (50 or 60 Hz).

    Note: An incorrect setting of line frequency can cause artifact or excessive waveform noise on the ECG waveform.
  - Language - selection appropriate for clinical site

- Test Pulse - Confirm or Cancel, one-shot test pulses for ECG (1mV spike) and Temp (–5°C and +50°C, respectively). An additional test is performed for IBP, Resp Pulse, and SpO_2. Test indication is reported in the trend table.)

• Exit

5.3 Alarm Limits Key

-- calls up a setup table for alarms.

1) Turn rotary knob to select desired parameter field and limits, and press knob in to activate your selection.
2) The number representing the limit value turns black on a blue background, indicating that you can change it. Turn knob to change value.
3) When desired setting is displayed, press knob in to set value.
4) Press *MAIN* Screen key to return to *MAIN* screen.

5.4 Alarm Silence Key

-- silences an active alarm tone for 1 minute ±5 seconds, and turns active blinking parameter areas into active steady parameter areas

5.5 All Alarms Off Key

-- suspends alarms for a fixed 3-minute ±5 second period.

5.6 NBP Start/Stop Key

-- starts and stops non-invasive blood pressure measurement.

5.7 Zoom Key

-- used for fast access to all parameters or NBP parameter box bottom channel screen setups, choice made from a user menu.

5.8 Record Key

With an R50™ recorder connected, press the Record fixed key to start a manual, timed recording.

Note: If a recorder is not connected, pressing the Record fixed key writes 15 seconds of waveform and vital signs information to internal memory. SC 6002XL monitors can store up to five recordings, which are automatically printed as soon as the recorder is connected.

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Chapter 2: Functional Description

1 Overview

SC 6002XL monitors are configured patient monitors running on one processor, an MPC821 Power PC processor, which attends to all monitoring functions, controls all graphics functions, generates video and timing signals for the LCD screen, and interfaces with the PCMCIA. It also performs several peripheral control functions, such as NIBP control, audio volume control, and timing generation for the front end. See Figure 2-1.

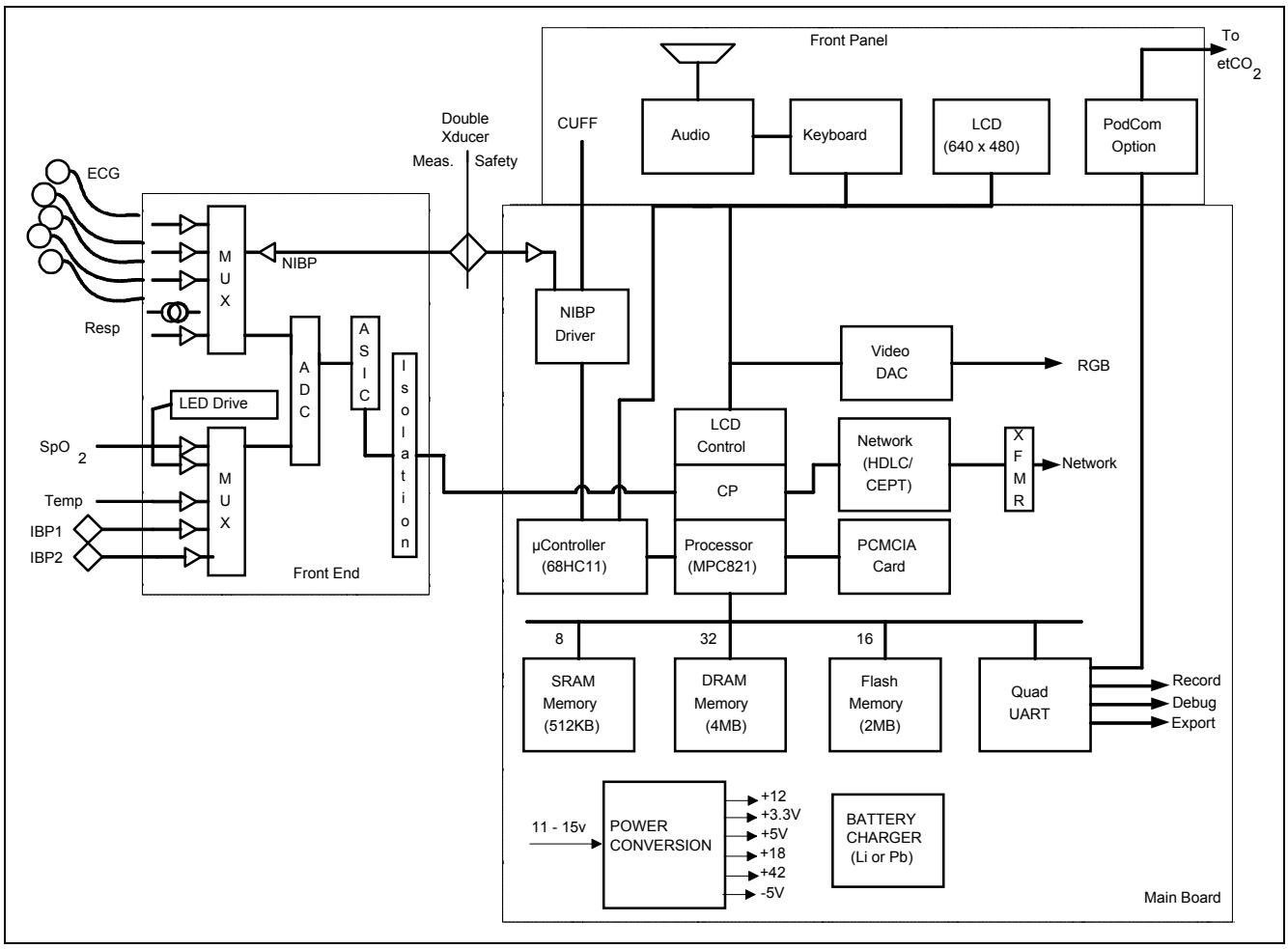

Figure 2-1 SC6002XL Patient Monitor Block Diagram

2 Parameter Inputs

The data acquisition front end acquires and digitizes signals derived from a three-, five-, or six-electrode ECG patient lead set, a Nellcor® SpO_2 transducer, an Impedance respiration measurement system, a thermistor-based Temperature transducer, and two strain-gauge IBP transducers (IBP2 = locked option). The NIBP main transducer signal is digitized together with the rest of the front end parameters. See Section 4 and Section 5 for more detailed information.

3 Main PC Board

The Main MPC821 Power PC processor not only attends to monitoring functions, but also controls all graphics functions, generates the video and timing signals for the LCD screen, interfaces with the PCMCIA, and controls the network link. In addition, it performs a host of peripheral control functions, such as NIBP control, audio volume control, and timing generation for the front end.

3.1 LCD Control

A set of buffer/drivers are used to drive the 6.5" screen. In parallel, a triple video DAC generates analog RGB signals for an external monitor (typically a CRT).

3.2 Network Interface

The SC 6002XL monitor interfaces with the physical interface device (e.g., CPS, IDS or IHUB) automatically when connection to the device has been detected. Connections to INFINITY network services are established and maintained by software components resident on both the SC 6002XL and the physical interface device.

3.3 Front Panel Circuitry

The front panel circuit processes the audio information, drives the fluorescent tubes on the LCD, implements a secondary alarm in case the unit resets or turns off, and routes the video and timing signals to the screen. It also routes the UART signal coming from the Pod interface to the main board Quad UART.

3.4 Pod Interface

The Pod Interface generates an isolated voltage to power the pod and also converts the Pod Comm protocol from the pod into a UART stream that can be interpreted by the microprocessor.

3.5 Battery Control and ON/OFF Control

The Pb-acid or Lithium battery charging and discharging cycles are controlled by a special charger circuit. The circuit initiates a charge cycle when commanded by the microcontroller. The charge cycle for a Pb-acid consists of a bulk charge period in which the battery is being supplied a constant current of ~400mA, a constant voltage period in which the battery voltage is held constant at ~14.8V and the current is allowed to diminish as the charge approaches 100%, and a float cycle in which the voltage is maintained at ~13.7V. For Lithium batteries, the charger circuit acts as a constant voltage source of 16.8V. The battery is charged from a switching supply controlled by the charger chip. The microcontroller also reads the front panel keys and the rotary knob, encodes the information coming from them, and routes it to the main processor. When the On/Stdby key is pressed, it turns the monitor on and off. In addition, the microcontroller controls the NIBP safety timer.

3.6 BOOT Process, Flash Memory, and DRAM

The BOOT EPROM contains the boot code and must be preprogrammed at the factory. It cannot be programmed after being installed on the Main board, and therefore cannot be updated in the field via a software download.

The executable software normally resides as compressed operational code in Flash memory. When the 68HC11 microprocessor senses that the on/off switch on the front panel has been pressed, it turns on (or turns off) the 3.3V and 5V supplies. As the 3.3V supply turns on, it wakes up the MPC821 main processor, which begins execution from the BOOT PROM. During boot initialization, the main processor attempts to read the Memory Card to detect legal software. If a legal software memory card is present, the software is loaded from the card. Otherwise, the main processor loads software from the Flash to the main processor DRAM, from which it completes initialization and enters operational mode. DRAM contains expanded operational code, and data space variables and stacks.

3.7 SRAM

The 512K x 8 SRAM is battery backed up and is used for error logs, trends, recordings and other non-volatile memory uses.

3.8 68HC11 Microcontroller

The 68HC11 Microcontroller, with 2K of EEPROM and 256 bytes of RAM, is powered as long as there is a main supply plugged into the system or when the user presses the ON/OFF button. The code is stored in its

internal flash memory, but can be downloaded from the MPC821. The microcontroller performs the following functions:

On/Off control	When the ON/OFF pushbutton (either local or remote is pressed), the microcontroller activates the 3.3V and 5V supplies, which wakes up the MPC821 through a power-on reset. In addition, the microcontroller has control over a flyback supply, which comes on any time the unit is plugged into AC power (in order to charge the battery) or is turned on. The microcontroller also reads the front panel keys and the rotary knob, encodes the information coming from them, and routes it to the main processor.
NBP Valve modulation	When directed by the main processor, the microcontroller supplies modulation signals for the two NBP manifold valves.
NBP Safety Timer	When the pump or the valve V2 are turned on, the microcontroller initiates a 128 sec. timer (90 sec. or 60 sec. for neonates) which, if exceeded, produces an NBP fault and results in cut off of main 12V power to the NBP manifold.
Battery Charger	The microcontroller initiates a battery charge when needed, and stops the charging process when the battery reaches full capacity. It can recognize whether a Pb or Lithium battery is connnected into the sytem, and directs the battery controller chip to charge to different levels depending on the battery type. See Section 3.5. The microcontroller also acquires the battery voltage and current for monitoring purposes.
Recorder Power	The microcontroller controls the power applied to a stand-alone R50 Recorder.
Main Audio Generator	The microcontroller generates the fundamental audio frequency of the unit's tone generator, as directed by the main microprocessor.

4 Front End

All physiological signals (except $etCO_2$) are digitized through a high speed multiplexing system and a common 16 bit ADC. The data is then transferred through the isolation barrier to an HDLC port in the main processor, where it is digitally filtered and processed.

4.1 NIBP Control

The NIBP main transducer signal is digitized together with the rest of the front end parameters. However, the redundant (overpressure) transducer is processed separately on the grounded end of the board, and the pump on/off signal and valve enable signals are generated off of the MPC 821 microprocessor. The PWM signals for the valve flow control and the redundant safety timer are implemented in a separate microcontroller (MC68HC11).

4.2 Safety

- Patient isolation withstands 5kV during defib.
- Leakage currents are limited to safe values normally and during single fault conditions.
- Patient is protected against electrosurgical burns at the electrodes.
- Defibrillation protection does not drain excessive current away from the patient.
- Specially shielded connectors and cables are used to provide excellent immunity up to 1000MHz and can not be touched by the patient even when disconnected.
- Single cable from MultiMed Pod to main SC6002XL unit reduces clutter between bed and monitor.

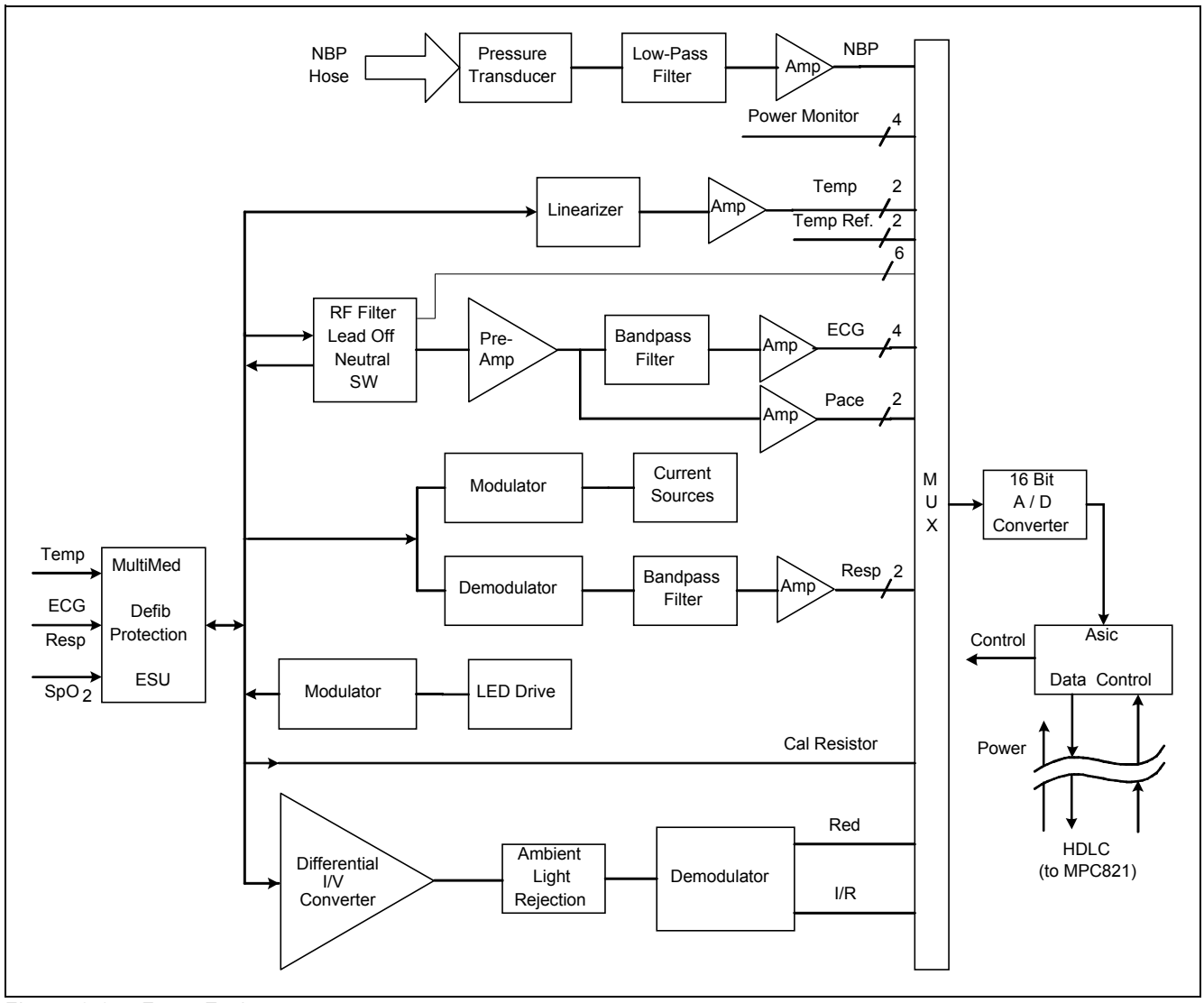

Figure 2-2 Front End

5 Physiological Parameter Data Acquisition

Transducers gather physiological data at the patient and feed them into the small MultiMed Pod at the bed. The MultiMed Pod in turn is connected via a 3-meter cable to the front end in the main unit where analog ECG, Respiration, Temperature, and SpO_2 signals are converted to digital form and sent through isolators for processing.

5.1 ECG/Resp

The MultiMed Pod located close to the patient accepts a set of 3, 5 or 6 shielded ECG electrode leads, an SpO_2 (Nellcor) cable adapter, and a temperature sensor. The ECG section contains RF filters, and overvoltage clamps that include 1k series resistors to limit shunting of defibrillator current. The SpO_2 and temperature sections also contain RF filters. Impedance respiration is sensed through the ECG electodes. Void-free potting and internal shielding enable compact containment of high voltage defibrillator and electrosurgery pulses. The small interconnecting cable to the main assembly is captive at the MultiMed POD but plugs into the MultiMed front end via a specially shielded connector.

The front end accepts physiological signals from the MultiMed POD connector and feeds temperature, respiration, and ECG signals via RF filters, configuration multiplexers, and pre-amplifiers to a high-speed

multiplexer driving a 16-bit analog-to-digital (A/D) converter. The data stream is sent to the Main Processor board via an opto-isolator. Control commands from the Processor are sent out to the front end on a similar isolating link. Isolated DC power is also provided.

The ECG signals are conductively coupled to the isolated circuits via current-limiting series resistors, whereas the SpO_2 signals are optically isolated at the transducer. Temperature signals are doubly insulated at the patient by disposable boots on the sensors. AC (40kHz) excitation currents for respiration monotoring are dc-isolated by high-voltage ceramic capacitors.

The A/D samples the following parameters:

Table 2-1 Parameter Sampling Table

Parameter	# of Channels
ECG	4
Pace	2
SpO_2 Red	1
SpO_2 IR	1
NBP	1
Resp	1
Temp	2

The hardware pace detector monitors the ECG signal in two of the four channels (those not connected to the chest leads). All other signals are decimated and filtered using digital signal processing in the MPC821. High oversampling rate is required to minimize the requirements (and size) of the analog anti alias filters. Superior rejection to ESU and other types of interference is achieved with this type of design.

5.1.1 ECG

- Bandwidth is set flexibly by software filters.
- Reconfigurable neutral selector can drive any electrode.
- Lead-on detection functions with even poor electrodes.
- Calibration voltages can be superimposed on patient wave-forms or onto flat baselines.

See Figure 2-3. Composite electrocardiographic (ECG) signals generated by the heart and by a pacemaker are filtered to reduce RF interference from impedance respiration and electrosurgery and then injected with dc lead-off detection currents. Over-voltage clamps protect the semiconductors from the surges passing the sparkgaps in the MultiMed Pod and also reduce the dc current applied to the patient due to a component fault.

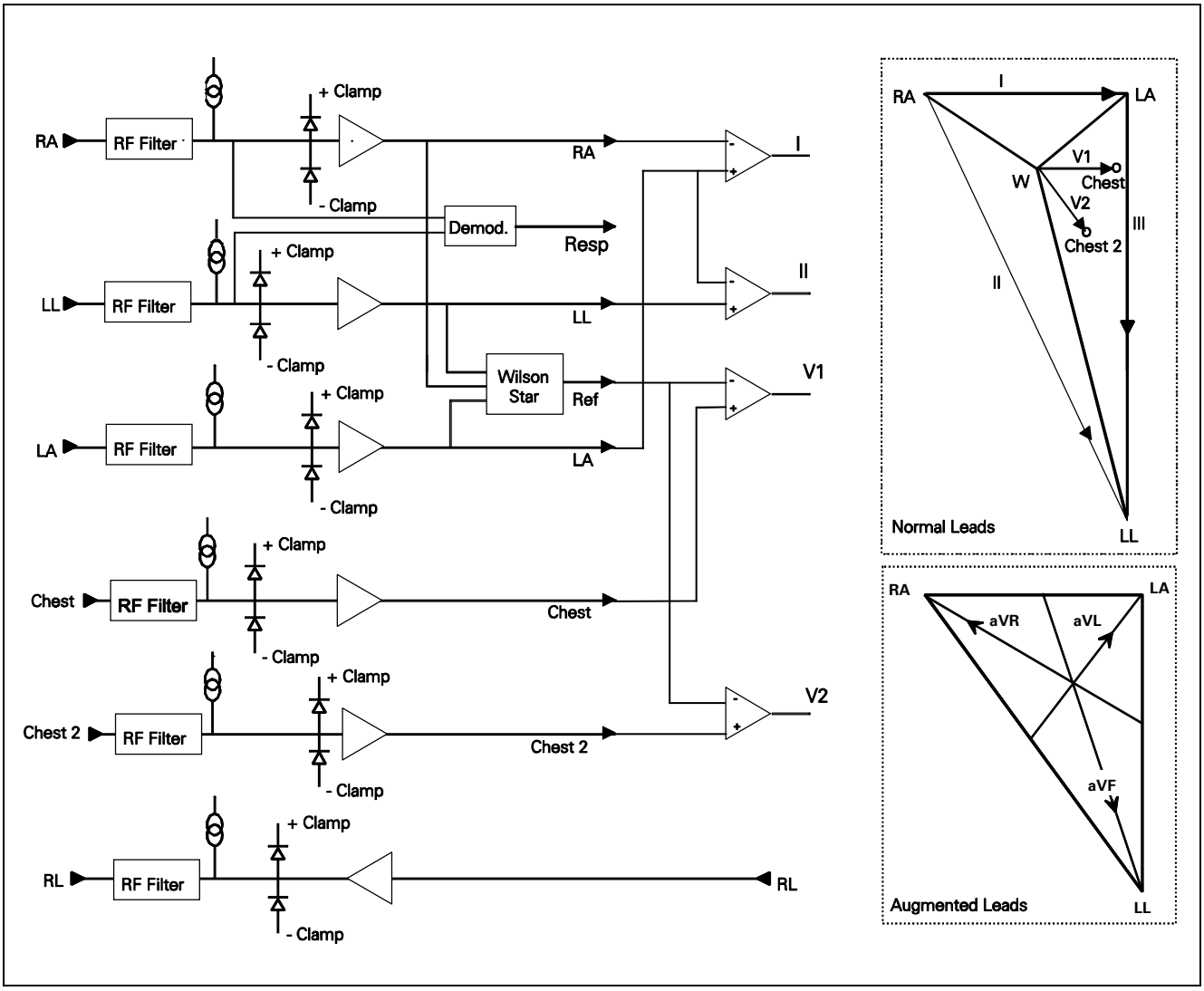

Figure 2-3 Lead-Forming Network

5.1.2 Lead Selection

A lead-forming network following the RF filter generates the necessary reference points for electrocardiographic measurements. Both normal leads (I, II, III, V1 and V2) and augmented leads (aVL, avR, and avF) can be obtained. See Figure 2-3.

Four differential channels generate the main axes I, II, V1 and V2. The remaining leads are derived mathematically as indicated in the vector diagram of Figure 2-3.

5.1.3 Lead-Off Detection

Lead-off detection is accomplished by introducing a very small current into each patient electrode, which would drive the corresponding input high if it were disconnected. A set of five comparators detects a lead-off condition.

5.1.4 Low-Pass Filtering and Common Mode Enhancement

The ECG preamplifier has a flat frequency response of 0.5 - 40Hz, with a software notch filter at 50/60 Hz. A 180° combined signal drives the neutral electrode to increase the CMMR.

5.2 Respiration

Impedance respiration is monitored by injecting a 40 kHz square wave of current into the RA electrode. The resulting 40 kHz voltage drop between the RA + LL electrodes is proportional to the impedance. Especially balanced true current sources do not load the ECG electrodes or distort the ECG morphology. The returning 40 kHz differential voltage is amplified, synchronously demodulated, and low-pass filtered. An AC-coupled stage with an "autobloc" DC restorer feeds the input to the A/D converter with a nominal output of 60 mV per Ohm.

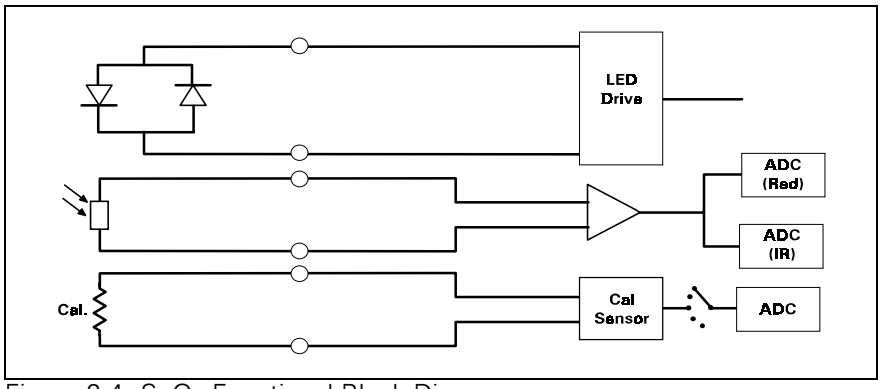

Figure 2-4 SpO_2 Functional Block Diagram

5.3 SpO_2

The pulse oximeter circuit uses a Nellcor® sensor to detect the oxygen saturation level in arterial blood flow. Determination of the concentration of oxygen in the blood is based upon the principle that the absorption of red (R) light depends on the degree of oxygenation of the blood, whereas the absorption of infrared (IR) radiation is relatively independent of oxygenation and causes only constant attenuation. See Figure 2-4. In the SpO_2 sensor, R and IR light emitting diodes (LEDs) are alternately pulsed ON at a 25% duty cycle. The light is transmitted through a well-perfused part of the body, such as a fingertip or an ear lobe. The intensity of light (including ambient) transmitted through or scattered by the blood is converted to a current by a photodiode in the sensor. The current that appears when both LEDs are OFF depends mainly on the ambient light, which is later subtracted to leave only the R or IR signal levels. The large dynamic range of the light intensities requires constant automatic monitoring and adjustment.

The intensities of the R and IR sources are independently controlled by two digital-to-analog converters (DACs) attenuating the 2.5 V reference. These levels or zero are sequentially selected by a multiplexer, and converted to a driving current which is further guided or inverted by an output multiplexer to the LEDs in the sensor.

5.3.1 SpO_2 Front End

The primary purpose of the SpO_2 front end is to convert the sensor's analog signal into individual digitized signals for the red and infrared analog signals for processing by the microprocessor. See Figure 2-5 on page 16. Circuitry in the front end first eliminates the non-pulsatile component in the input signal, then demultiplexes the resulting pulsatile signal to separate the R and IR signal components, and finally converts the demultiplexed R and IR analog signals into serial digital data streams.

A sequence of light pulses, driven from the chopped current source in the sensor LEDs, are passed through a finger or an earlobe to a photodiode. The sensor LEDs are connected in an anti-parallel fashion on one pair of wires.

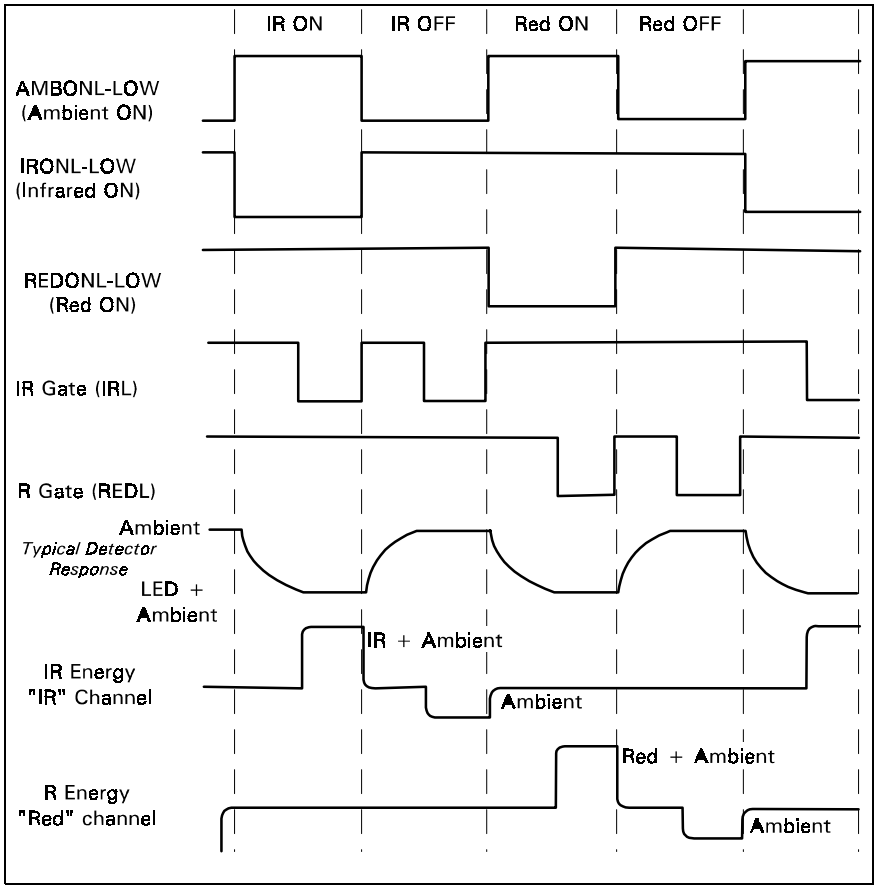

Figure 2-5 Sensor LED Timing Diagram

A timing generator controls the sensor LEDs and signal multiplexing/ demultiplexing (see Figure 2-5) by means of three control signals:

- *IRONL* (infrared LED)
- *AMBONL* (LEDS not lit)
- *REDONL* (red LED)

5.3.2 Input Stage

A preamplifier converts the photocurrent to an equivalent voltage, and applies it to a 20 Hz high-pass filter that removes the non-pulsatile component. The output of the preamplifier is fed to a saturation detector.

5.3.3 Brightness Control

If the output of the preamplifier is in saturation, the gate array provides a signal to the digital-to-analog converters (DACs), which controls the drive current to increase or decrease the brightness of the LEDs.

Controlling LED brightness extends the system dynamic range. For a very transparent subject it may not be possible to reduce the gain to prevent saturation. In that event, the brightness must be reduced. An additional purpose is to equalize the received amplitude of each wavelength. If both LEDs are turned ON to maximum brightness, and the software finds an extraordinary difference between the two, the microprocessor tends to reduce that difference by equalizing the R or IR brightness signals.

5.3.4 Ambient Light Rejection Amplifier

The ambient rejection amplifier is a synchronous detector. The signal appied to its inverting input is a composite of R, IR, and ambient signals. The non-inverting input is the same signal gated by the timing generator. This synchronously multiplexes the IR, ambient, and R analog signals.

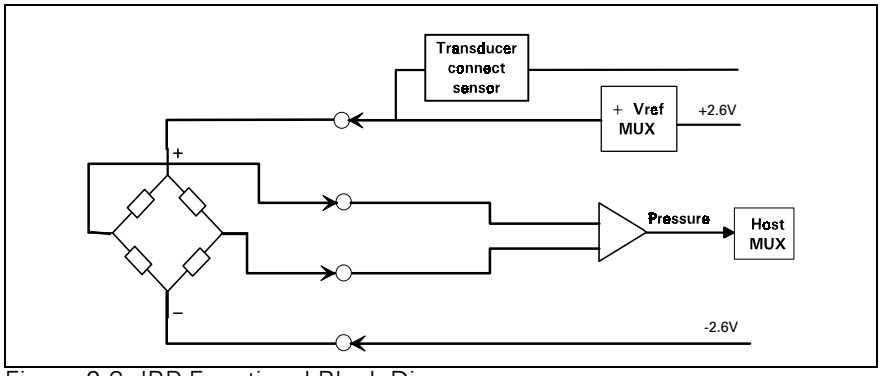

Figure 2-6 IBP Functional Block Diagram

5.4 Invasive Blood Pressure

The IBP circuit has been designed to be used with a strain gauge pressure transducer. See Figure 2-6. The analog portion of the IBP circuit provides excitation voltages for resistance bridge transducers. These voltages are derived from a reference which is also used to derive the A/D converter reference voltage. At the circuit input, a resistor divider network provides for transducer unplugged detection. R-C filtering and protection diodes limit the effects produced during electrosurgery, defibrillation, and other such procedures. A selector multiplexer allows for the insertion of calibration signals into the amplifier stage. The multiplexor feeds the pressure signal to a buffer amplifier, which in turn feeds the AD converter analog input. This allows the monitor to measure pressure signals in a range greater than ±700 mmHg with a resolution of approximately .02mmHg/LSB.

When no pressure transducer is plugged into the monitor, the resistor divider network puts a negative signal into the instrumentation amplifier, which propagates through the system to indicate the unplugged condition.

5.5 Non-Invasive Blood Pressure

Refer to Figure 2-7 on page 18.

5.5.1 NBP Subsystem

The NBP subsystem consists of the following components:

- pump
- two modulating valves
- strain-gauge pressure transducer
- overpressure sensor
- pneumatic manifold

In addition, an electronic data acquisition and control system measures and digitizes the pressure pulses as the cuff inflates and deflates. Pump and valve control circuitry engage these elements as needed in the measurement cycle. Several interlock systems and expiration timers ensure the safety of the equipment in case of single point failures.

The SC6002XL NBP circuit uses a cuff and the oscillometric method to determine blood pressure without using a microphone. A strain-gauge pressure transducer is DC-coupled to a 16-bit A/D converter, so that cuff pressure is measured with adequate resolution to detect blood pressure pulses. This eliminates the need for a separate ac-coupled measurement channel, with its associated distortion and long transient recovery.

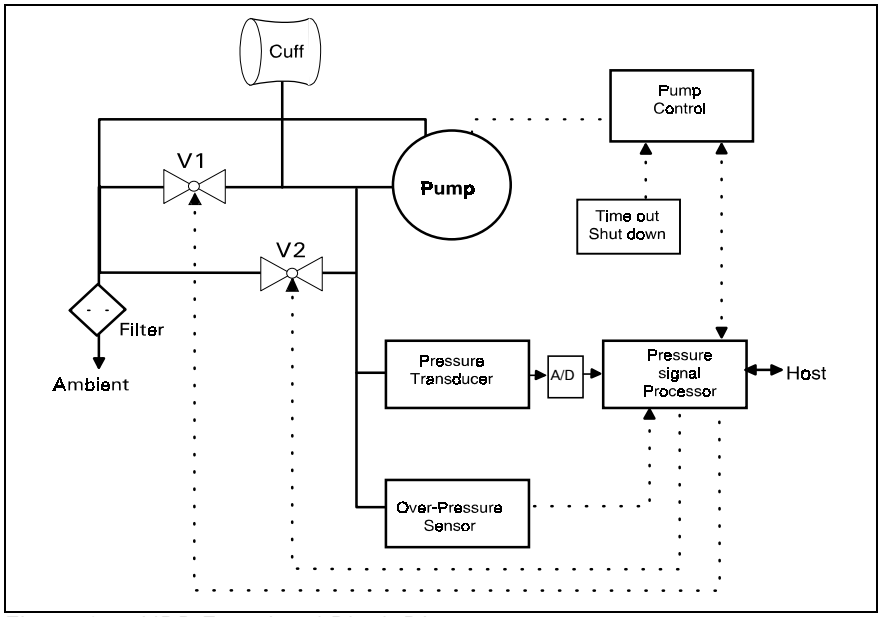

Figure 2-7 NBP Functional Block Diagram

5.5.2 NBP System Description

The combination of high-resolution A/D conversion and digital filtering, together with wide-range linear deflation control allows the circuit to measure blood pressure very rapidly and accurately, and to recover quickly from motion artifacts. The non-invasive pressure system is composed of the following components:

- pneumatic assembly
- electronic circuitry, mounted on the Main CPU Board

Pneumatic Assembly

The pneumatic assembly contains a pump, two modulating valves (V1 and V2), two air filters (intake and manifold), and a manifold assembly which interconnects these components. The pump provides the pressurized air to inflate the blood pressure cuff. V1 and V2 control the air flow during the deflation phase of a blood pressure measurement. V1 is a normally-closed exhaust valve with a relatively small orifice (relative to V2). V2 is a normally-open exhaust valve with a relatively large orifice. The pump speed can be controlled to permit accurate inflation pressures for special applications. The filters prevent potential contamination of pneumatic components by debris coming from the cuff or hose.

Electronic Circuitry

The electronic circuitry, mounted on the Main CPU Board, contains the electrical drivers for the pump, the valves, and its power supplies. In addition, the readback from the pressure transducer is processed through the floating section ADC. The software data acquisition and algorithm processing is performed in the MPC821 main processor.

5.5.3 Operation

The measurement sequence consists of an inflation phase, in which the air pump inflates the cuff, which has been wrapped around the patient's limb (typically the upper arm or thigh) to a predetermined pressure. At this point, the blood circulation to the limb is occluded. The monitor then linearly deflates the cuff at a software-controlled rate during which time the blood pressure parameters are determined by digital filtering and analysis of waveform data obtained from the pressure transducer during the deflation cycle.

Inflation Phase

When a blood pressure measurement is initiated (via software or front panel fixed key), V2 closes, the pump turns ON, and the pressure transducers monitor the ensuing pressure rise. When the pressure has reached the target inflation pressure, the pump turns OFF and a dynamic braking circuit rapidly brings the pump to a halt. The target inflation pressure adapts to the patient's systolic pressure, just occluding the blood flow. The software monitors the slope of the pressure curve during inflation to estimate the cuff volume, a factor used in the deflation sequence.

Deflation Phase

After the pump stops, there is a short delay to allow thermal transients to settle. Either V1 or V2 is modulated to control the deflation rate. The choice of V1 or V2 and the initial pulse width is made based on the estimated cuff volume determined during the inflation cycle. The chosen valve is modulated at a 20 Hz rate, and the pulse width (open time) is continuously adjusted to provide a linear deflation rate. If initial deflation was started with V1, the software may determine that it needs to switch to V2 to maintain proper deflation. In either case, V2 opens fully (de-energizes) when the measurement cycle is ended to allow for rapid and complete deflation.

5.5.4 NBP Hardware

Pump control circuitry provides the following three functions:

- limits the current to the pump when it starts, to prevent power supply overload
- dynamically brakes the pump when the pump is shut off
- provides a closed-loop speed control for special low-flow operations

Speed Control

Pump speed is controlled by measuring the back-EMF generated by the motor winding, which is directly proportional to the speed. However, to obtain a measurement of the back-EMF, the drop caused by copper losses must be added to the voltage appearing on the motor winding. The speed control effectively drives the pump at constant full speed.

Current Limit

Dedicated circuitry limits the current to the pump. When the current on the pump is approx. 363 mA, the current loop takes over and limits its value. The microprocessor and an N-channel FET turn the pump ON.

5.5.5 Valve Control

A relatively high pulse voltage is used to drive V1 and V2 to get quick response and extend the pulse-width flow control range.

5.5.6 Power Supplies

Separate control logic supplies voltage (+12V) to the pump and V2 to provide them with redundant turn-off capability. Without +12V the pump cannot run, and V2 can neither close nor remain closed. Power supplies necessary for operation of the NBP circuitry are derived as follows:

+5V and -5V Supply

The +5V and -5V for the NBP analog circuitry are derived from the floating section.

+12V Supply

The +12V drives the NBP pump and both modulating valves. The 6002XL flyback supply produces the +12V. This circuit produces several voltages needed for monitor operation. The main flyback regulation loop is closed around the +12V output, therefore making it the best regulated of the multiple voltages generated.

In operation, a resistor network samples the +12V output and feeds it into the controller chip error amplifier, which compares it to an internal reference. The duty cycle of the switching transistor is adjusted to null this reference. A separate current feedback loop is used to stabilize the circuit and provide current limiting protection.

+36V Regulator

A +36V supply used to accelerate the energizing of the valve coils is derived from the 42V raw supply generated by the flyback supply.

5.5.7 Power Supply Monitor

The power supply monitor circuit provides reset logic to the microprocessor, and the redundant power switch circuit, both at power-up and in the event of a power failure or voltage drop. The heart of the monitor is a power supervisor chip. At power-up, the control line is held low for a period of about 200 ms, after which the voltage rises to the +5V level. After start-up, any dip in the +5V that causes the output to go to less than +4.75V causes the same sequence. A resistor network is used to monitor the +12V supply. When the voltage on the reference signal falls below +1.25V, a reset sequence similar to the one described above ensues. The +5V and -5V are monitored via the floating section ADC.

5.5.8 Safety Timer

The safety timer becomes active only after starting the pump at least one time. Once the pump has been activated, the timer circuit operates regardless of whether the pump has been turned off. Starting of the pump is sensed by voltage developed across the pump sense resistor. If as a result of some failure, hardware or software, the pump continues to run longer than the timer expiration period, a microcontroller output rises and opens a redundant switch, which causes the pump to turn off and V2 to open.

The safety timer period is derived from the microcontroller clock. Note that, for redundancy purposes, the safety timer is implemented not in the MPC821 but in the 68HC11 microcontroller.

Among other signals multiplexed into the floating section data stream are power supply monitor voltages. Measuring these voltages gives an indication of the integrity of the power supplies and the A/D converter voltage reference.

5.5.9 Pressure Channels

Pressure fluctuations in the cuff change the balance of the pressure measurement bridge, resulting in a differential voltage which is fed into an amplifier. The gain of the amplifier is determined by the setting of a calibration potentiometer. This potentiometer is initially adjusted in the factory, and from then on the calibration should be checked every year.

The overpressure hardware is fed by a single power source. This increases safety of the system, since a failure of the reference voltages does not impact operation of the overpressure channel. An overpressure test is performed at each power-up cycle to ensure that the overpressure circuitry is working. Any error detected in the overpressure comparator circuit is fed to the redundant power switch circuitry described above. The software overpressure detection is completely independent of the overpressure circuitry.

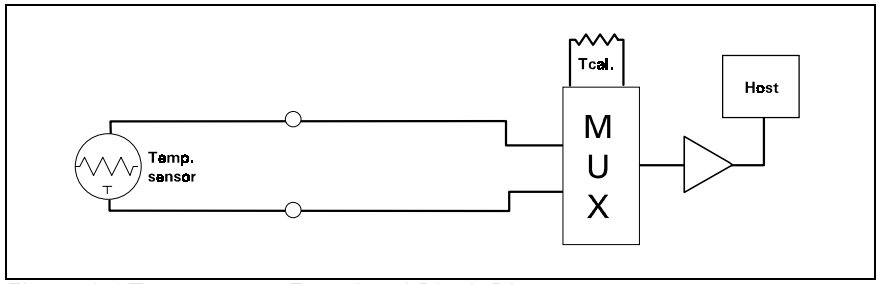

Figure 2-8 Temperature Functional Block Diagram

5.6 Temperature Circuit

Temperature measurements are made using a thermistor probe that is electrically equivalent to YSI® 400 series probes. See Figure 2-8.

5.6.1 Reference Networks

Two independent reference networks are used to verify correct circuit function by measuring the difference between the reference network ratio values (simulating -5°C and +50°C temperatures), and reporting an error if that difference exceeds the expected range of values. The reference networks are also used to cancel offset and gain errors in the measurement circuits. The measurements of the two references allows for the determination of circuit offset and gain within the accuracy of the reference networks.

5.6.2 A/D Converter

A resistor network linearizes the voltage versus temperature curve of the thermistor to within ±2°C. Later the curve is further linearized to 0.01°C, using a look-up table in the microprocessor. The maximum power to the thermistor element is limited to 50 µW. To maintain high accuracy, all signal voltages are ratiometric to the A/D converter voltage reference. The sensitive electronics are protected from damage by an RF filter and an overvoltage clamp.

A multiplexer selects one of three inputs: T1, T-5, or T50. T-5 and T50 are used in a two-point error correction algorithm, to measure the actual gain and offset of the measurement circuit. The T-5 and T50 voltages are created by precision resistor dividers, and are calculated to simulate the voltage that would appear at T1 when a thermistor probe is at a temperature of -5°C and 50°C, respectively.

When a thermistor probe is disconnected from the measurement circuit, the voltage at the input to the A/D converter reaches a value that is above positive full scale. The microprocessor is programmed to interpret a positive full scale value from the A/D converter as a probe disconnect.

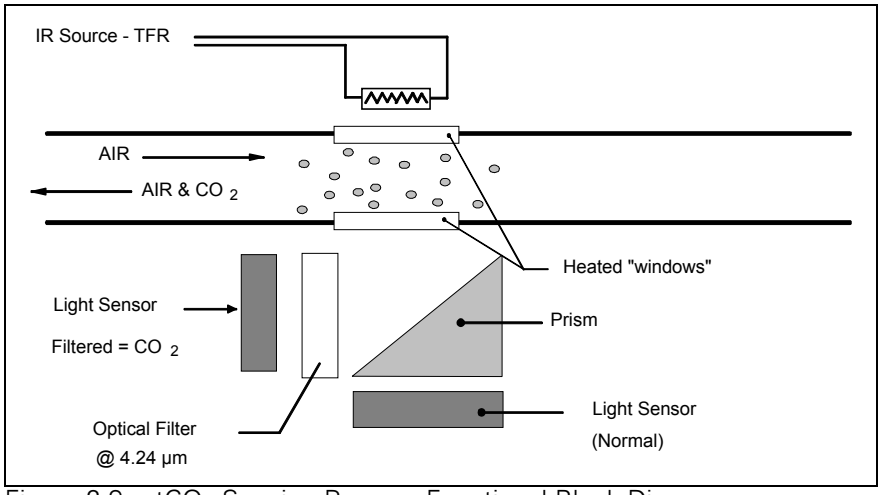

Figure 2-9 $etCO_2$ Sensing Process Functional Block Diagram

6 $etCO_2$ Pod

The $etCO_2$ pod non-invasively monitors end-tidal CO_2 using a technique that relies on the selective absorption properties of the CO_2 to specific frequencies of infra-red radiation. See Figure 2-9.

In the sensor a thick film infra-red source is pulsed at a rate of approximately 87 Hz, generating a broad- band spectrum of IR. Selective filtering separates this into two narrow regions, one inside and one outside the band of CO_2 absorption. The detector associated with the filter outside the band of CO_2 absorption records the maximum level of the source energy since the signal it receives is not affected by CO_2. It provides a baseline which serves as a Reference for the level of CO_2 in the airway.

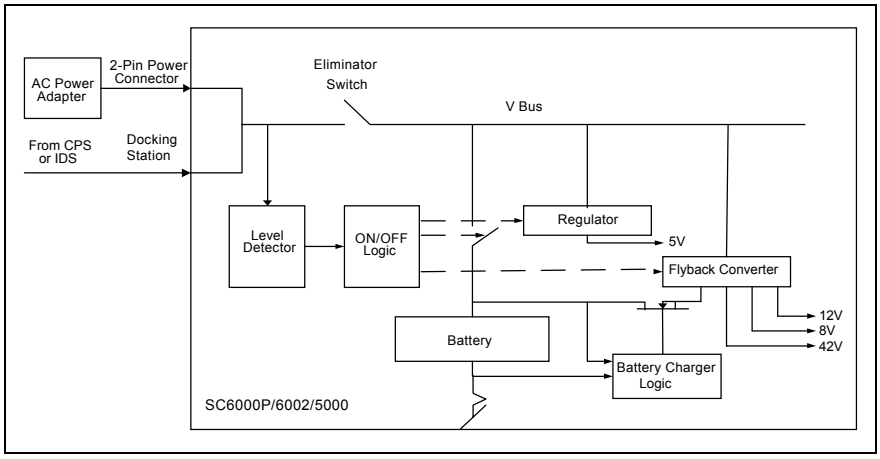

Figure 2-10 Power System Block Diagram

The other detector senses a filtered energy level modified by the presence of CO_2. As the level of CO_2 increases, the CO_2 gas molecules in the airway absorb more of the light energy and less signal reaches the detector. This signal, converted by the detector, is referred to as the Data signal. Current through the thick-film source is bidirectional to offset the tendency of particles within the source to migrate when exposed to a strong unidirectional electric field caused by current flow only in one direction. This keeps the structure of the source uniform and enhances system integrity and life of the product.

To acquire a precise level of CO_2, both channels are simultaneously sampled and the level of CO_2 is determined from the ratio of the Data and the Reference channels. The ratio is compared to a look-up table in memory to establish the correct value in units of mmHg.

The pod then sends the results to the PodCom input of the SC 6002XL for further processing and display.

6.1 Power Supply System

The monitor can be powered from any of several sources --

- A lead-acid or lithium-ion battery, housed in the monitor
- A CPS (Communication/Power Supply), through a docking station,
- An IDS (INFINITY Docking Station)
- An AC power adapter

As illustrated in Figure 2-10, the ac power adapter and the CPS/IDS are connected in parallel. The monitor is normally powered by a CPS via a docking station, or an IDS, in a "pick-and-go" application, and by the ac power adapter in a stand-alone application. If both supplies were to be connected simultaneously the one with a higher voltage would take over.

Two solid state switches, the eliminator switch and the battery switch, govern supply of power to the monitor and charging of the battery. In addition, there are three DC/DC converters, two buck regulators that produce the main +5V and +3.3V, and a multi-output flyback supply that generates three auxiliary voltages, including the voltage that is used to charge the battery.

On/Off logic circuitry manages the condition of the switches and the DC/DC converters under different circumstances, and responds to the On/Off pushbutton on the monitor front panel. The logic is implemented in the microcontroller.

6.1.1 Main Battery

A lead-acid main battery should sustain autonomous operation of the monitor for approximately 75 minutes. A lithium-ion main battery should sustain autonomous operation of the monitor for approximately 180 minutes. When the battery eliminator is connected, power to the load and charging power for the battery is provided from the AC mains.

To be fully charged, lead-acid batteries require a voltage of approximately 2.45 V/cell at 25°C (14.7 V in SC 6002XL monitors). This voltage should not be sustained after full charge has been reached, however, because the battery starts to outgas which reduces its life. Therefore, voltage to the battery must be reduced to 2.30 V/cell at 25°C. This is known as the "float" voltage. At this voltage the battery can remain indefinitely connected to the monitor, ready to deliver current when necessary. The charging circuitry in the SC 6002XL automatically varies the charging cycle. Lithium-ion batteries require a constant charging voltage. See Section 3.5 above.

6.1.2 AC Power Adapter

The ac power adapter is a regulated 12V (nominal) supply with enough current capability to supply the load and charge the battery at the same time. The eliminator switch (see Figure 2-10) is turned ON when the input voltage exceeds 11.25 V, allowing the ac power adapter to feed the rest of the monitor circuitry. The battery is charged from the output of the flyback supply through a regulating FET and a low-value sense resistor.

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Chapter 3: Subassembly Replacement Procedures

1 Introduction

This chapter describes how to replace hardware that Siemens has identified as field-replaceable in an SC 6000XL Patient Monitor. Siemens recommends use of a small common-blade screwdriver such as Stanley 64-846 or equivalent, for removing side panels and opening the monitor. Individual field-replaceable parts and subassemblies can be replaced using only the small common-blade screwdriver or Siemens side-panel removal tool (Art. No. 47 24 667 E533U), and a small Phillips-head screwdriver.

2 Safety Precautions

Disconnect all external power, and remove the battery cover and battery before opening the monitor.

Caution

- Failure to remove the battery before opening the monitor may result in damage to the Main Board.
- SC 6002XL monitors contain electronic components that can be damaged by electrostatic discharge. Open the monitor case only in a static-protected environment. Observe standard procedures for protecting the equipment from static electricity.

- **Open monitor only in a dust-free environment**. This is particularly important when replacing subassemblies or components in the Front Panel Subassembly.

3 Service Policy and Replaceable Parts

Qualified service personnel may replace the following specific items in the field. Component-level repairs should not be attempted, and void any warranty or exchange allowance for returned subassemblies. **Siemens recommends a full functional verification following replacement of any internal subassembly in the Monitor.** Refer to Appendix A for Replacement part numbers.

- Battery Door and Main Battery (see User's Guide)
- Rotary Knob
- Foot Pads
- Backlights
- Speaker
- Optical Encoder
- Main Processor Subassembly
- Monitor Handle
- TFT-LCD Display
- Front Panel PC Board
- Inverter PC Board
- PodCom PC Board
- Intermediate Subassembly
- Side Panels
- NBP Pneumatic Assy
- NBP Air Filters
- Battery Connector Subassembly

4 Non-Invasive Replacement Procedures

Only the Battery, Battery Compartment Door, Rotary Knob, and Foot Pads can be replaced without requiring the monitor to be opened. Refer to any User Guide for the SC6002XL Patient Monitor for the procedure to replace the battery or battery compartment door.

4.1 Replacing Rotary Knob

The rotary knob is press fitted onto the metal shaft of the optical encoder subassembly, and can be reinstalled if carefully removed. If damaged during removal, it must be replaced.

To remove the knob, grip it **very** firmly with vise-grip pliers or a similar tool, and pull it straight out and off of the metal shaft of the optical encoder. Avoid turning the knob in the process.

Note: Placing a small piece of soft cloth on the knob before gripping it with vise-grip pliers can help protect the knob.

To install a new knob (or reinstall a knob), firmly press knob onto the shaft.

4.2 Replacing Foot Pads

Two feet are on the bottom of the Front Bezel Subassembly, and two are on the bottom of the rear housing. The pads are secured in foot wells with adhesive. Replace the pads as follows:

1. Remove all remnants of existing pad and adhesive from foot well.
2. Remove protective covering from adhesive surface of replacement pad.
3. Position replacement pad in foot well, and press firmly on pad to secure it in well.

5 Accessing Replaceable Subassemblies

In order to access replaceable subassemblies, the monitor must be opened. First remove the battery compartment cover and battery, and set safely aside. Then remove the left and right side panels in order to enable removal of the Front Bezel and opening the monitor.

To view the process, click on the picture.

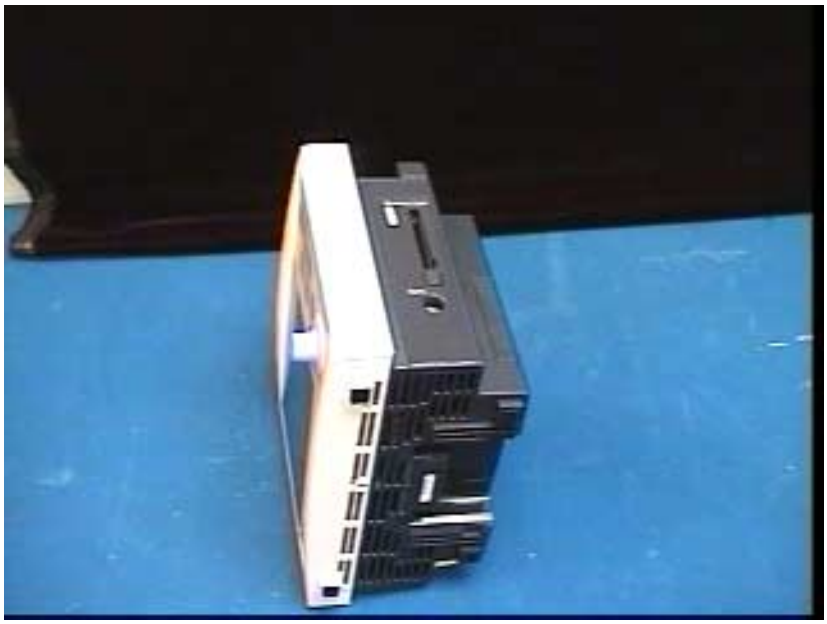

Figure 3-1 Right Side Panel Removal

5.1 Removing Side Panels

The Right and Left Side Panels are secured to the rear housing by locking tabs and a latching tab. Complete the following steps to remove side panels.

5.1.1 Removing Right-Hand Side Panel

1. Remove and save ejection shaft cover, using either a or b to remove ejection shaft cover, before attempting to remove Right Side Panel. See Figure 3-1.

   a) Insert PCMCIA card into the slot to make ejection button accessible

   b) Insert pointed end of small screwdriver between cover and side panel, as shown in Figure 3-2, and pry cover out of hole.

2. Carefully rock cover off of ejection shaft using back and forth motion.

> **Caution**
>
> Pulling on the cover with excessive force can pull the shaft completely out of the ejector mechanism, requiring depot repair of the monitor.

3. Set cover aside, remove PCMCIA card (if used), push shaft back into monitor, and go to Section 5.1.1.
4. Turn monitor left side down on a clean flat surface.
5. Carefully insert small screwdriver into ejection button opening on panel, at a shallow angle as shown in Figure 3-1, and use tool as a lever to lift side of panel approximately 1/8" (3mm). **Do not angle tool toward memory card slot**.

   Note: This lifts the locking tab out of its slot in the monitor housing, permitting the panel to move.

6. With side of panel lifted, carefully slide panel in direction shown, to release locking tabs from slots and remove panel.

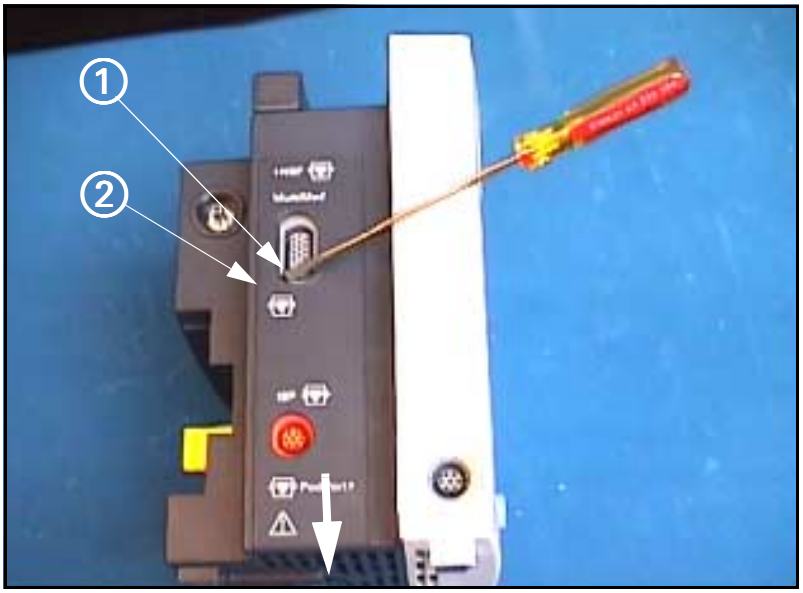

Figure 3-2 Removing Left Side Panel

5.1.2 Removing Left Side Panel

1. Carefully insert screwdriver or side-panel removal tool into MultiMed connector opening (① in Figure 3-2), at a shallow angle as shown. Use tool as a lever to lift side of panel approximately 1/8" (3mm) at ② in Figure 3-2. This releases panel latch.
2. With side of panel lifted, carefully slide panel in direction illustrated by heavy arrow, to release locking tabs from slots and remove panel.

5.1.3 Reinstalling Side Panels

1. For each side panel, position planel so that locking tabs and latching tabs are aligned with appropriate slots in rear housing.
2. Press into housing with a slight upward motion, in direction opposite to that indicated in Figure 3-1 or Figure 3-2, until panel seats properly and clicks into place.
3. Press ejection shaft cover onto ejection shaft on Right Side Panel.

   Note: Cover can be properly installed in only one orientation (so that slot in cover is toward back of Monitor) and installs easily when properly oriented.

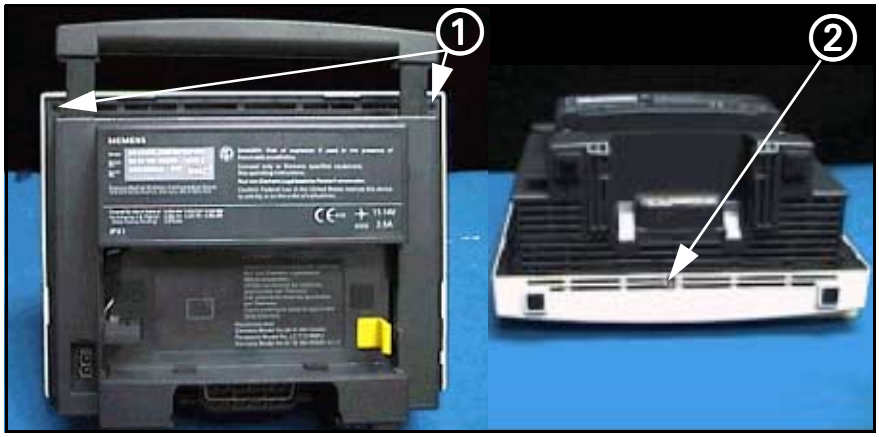

Figure 3-3 Bezel Retaining Screws

5.2 Front Bezel Removal

1. After removing battery compartment cover and battery, remove and save side panels (refer to Section 5.1).
2. Remove and save two bezel retaining screws in upper corners of Intermediate Subassembly frame (① in Figure 3-3) and one in bottom center of bezel (② in Figure 3-3).

To view the process, click on the picture.

Figure 3-4 Front Bezel Removal

3. Carefully insert flat blade of Siemens Side Panel Removal Tool into rear slot of Front Bezel Subassembly as shown in Figure 3-4, and apply pressure away from monitor to depress internal locking tab and partially release bezel.
4. Repeat step 3 to depress remaining three tabs, working in a counter-clockwise fashion, and carefully separate Front Bezel Subassembly from rear housing subassembly.
5. Place monitor backside down, with bottom of monitor facing you, and carefully lift left side of Front Bezel Subassembly up from rear housing subassembly. Refer to Figure 3-4.
6. Unplug optical encoder connector from connector on Front Panel PC Board.
7. Unplug flat cable from connector on Front Panel PC Board.
8. Do either a or b below, as appropriate.

   a) If removing Front Bezel Subassembly only to replace Optical Encoder Subassembly, set rest of monitor safely aside and go to Section 5.3.

   b) If removing Front Bezel Subassembly to access other sub-assemblies in monitor set Front Bezel Subassembly safely aside and go on to appropriate Section.

5.3 Replacing Optical Encoder Subassembly

1. Remove rotary knob, ① in Figure 3-5, (see Section 4.1) and then separate Front Bezel Subassembly from rear housing (Section 5.2.
2. Unscrew securing nut on front bezel (② in Figure 3-5 on page 29) to free Optical Encoder Subassembly (③ in Figure 3-5) from Front Panel Subassembly and remove optical encoder from back of front panel.
3. Position new Optical Encoder Subassembly in front bezel, oriented as illustrated in Figure 3-5, and secure subassembly to bezel.

   Note: Keyed washer (④ in Figure 3-5) assures proper orientation of Optical Encoder Subassembly in Front Panel Subassembly, and prevents turning of the optical encoder when rotary knob is turned in normal operations. Be sure to reinstall lock washer (⑤ in Figure 3-5).

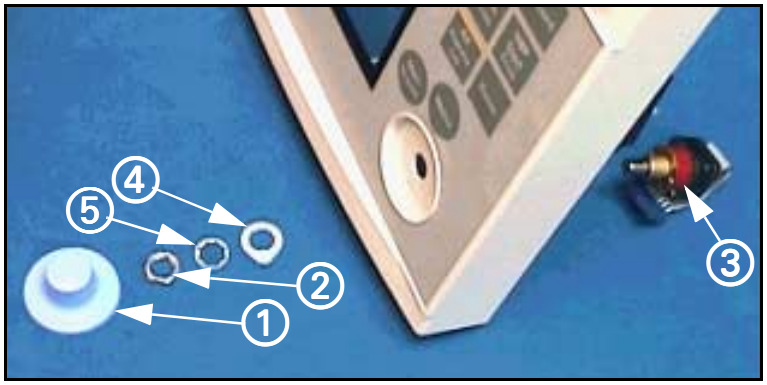

Figure 3-5 Optical Encoder Subassembly

4. Orient knob properly with flat area on shaft of optical encoder, and press knob firmly onto shaft.
5. Reinstall Front Bezel Subassembly on monitor. Refer to Section 5.4.

5.4 Front Bezel Installation

1. Place monitor on a clean flat surface so that face (TFT-LCD display) of monitor is up and bottom side of monitor (feet side) is positioned in front of you.
2. Reverse procedure of Section 5.2 to reinstall Front Bezel Subassembly. Press front bezel and rear housing together to assure four locking tabs on sides of front bezel lock into place in Intermediate Subassembly.
3. Reinstall and tighten screws removed in step 2 of Section 5.2 above.
4. Reinstall Side Panels (see Section 5.1.3), battery, and battery compartment cover.
5. Functionally verify proper operation of Monitor. Refer to "Chapter 4: Functional Verification and Calibration" on page 47.

To view the process, click on the picture.

Figure 3-6 TFT-LCD Display Subassembly

5.5 Removing/Installing TFT-LCD Subassembly

5.5.1 Removing TFT-LCD Subassembly

1. After removing Front Bezel Subassembly (see Section 5.2), remove and set aside TFT-LCD Display Subassembly screws as shown in Figure 3-6.

   Note: Note screw sizes and types so that they can be reinstalled in same locations when reassembling monitor.
2. Insert flat blade of removal tool into PC board latch and lift slightly up on board and metal plate to release from latch, as shown.
3. Gently lift metal plate and Front Panel PC Board to unplug Front Panel PC Board connector from PODPORT PC Board connector (if Option installed) and Front Panel PC Board interface connector from Intermediate Subassembly.
4. Unplug speaker cable from Front Panel PC Board.
5. Remove TFT-LCD Display Subassembly from monitor chassis and place face down on clean flat surface in static-protected environment.

5.5.2 Installing TFT-LCD Display Subassembly

1. Reverse procedure of Section 5.5.1 to install TFT-LCD Display Subassembly.

   Note: If installing a new TFT-LCD display, remove protective film from TFT-LCD display screen prior to installing Front Bezel.

2. Refer to Section 5.4 to reinstall Front Bezel Subassembly and reassemble monitor.

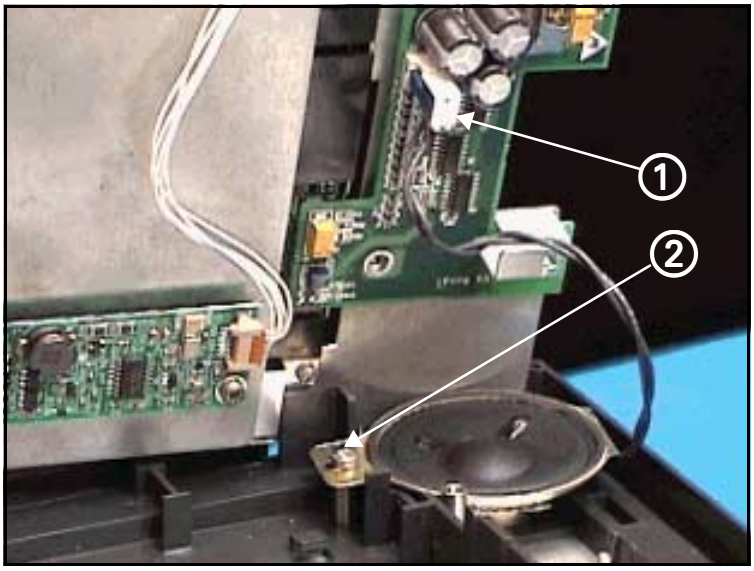

Figure 3-7 Speaker Subasssembly Connector

5.6 Speaker Replacement.

1. After removing TFT-LCD Display Subassembly (refer to Section 5.5) remove and save screw (② in Figure 3-7 on page 31).
2. Lift Speaker Subassembly out of positioning well.
3. To install new Speaker Subassembly, locate speaker in positioning well in Intermediate Subassembly, and then reinstall screw saved in step 1.
4. Refer to procedure of Section 5.5.2 to reinstall TFT-LCD Subassembly and reassemble monitor.

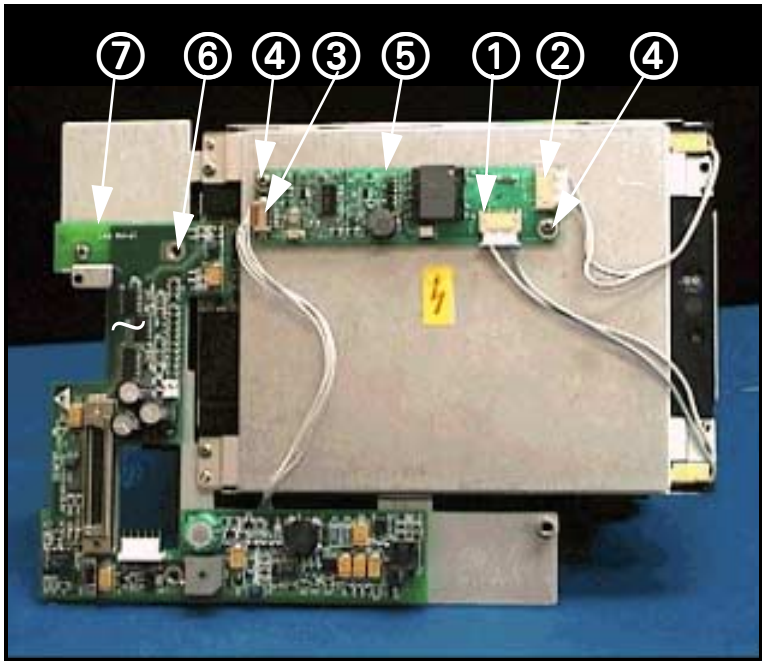

Figure 3-8 TFT-LCD Display Subassembly (Back View)

5.7 Front Panel PC Board Replacement

Removing Front Panel PC Board

1. Remove TFT-LCD Display Subassembly from monitor chassis (refer to Section 5.5).
2. With back of TFT-LCD display facing up as shown in Figure 3-8, unplug front panel board cable from connector from X3 (③).
3. Remove securing screw (⑥ in Figure 3-8) and lift Front Panel PC board (⑦ in Figure 3-8) off of TFT-LCD Display Subassembly.

Installing Front Panel PC Board

4. Complete steps 1- 4 above in reverse order to install Front Panel PC Board and reassemble TFT-LCD Display Subassembly.
5. Refer to Section 5.5.2 to reinstall TFT-LCD Display Subassembly and reassemble monitor.

5.8 Inverter Board Replacement

Removing Inverter Board

1. Remove Front Bezel Subassembly (see Section 5.2) and TFT-LCD Subassembly (see Section 5.5) from monitor chassis.
2. With back of TFT-LCD display facing up as shown in Figure 3-8, unplug backlight cable connectors from X1 and X2 (① and ② in Figure 3-8), and front panel board cable from connector from X3 (③ in Figure 3-8)).
3. Remove two screws (④ in Figure 3-8), and lift Inverter PC Board (⑤ in Figure 3-8) off of TFT-LCD Display Subassembly.

Installing Inverter Board

4. Complete steps 1-3 above in reverse order to install Inverter PC Board and reassemble TFT-LCD Display Subassembly.
5. Refer to Section 5.5.2 to reinstall TFT-LCD Display Subassembly and reassemble monitor.

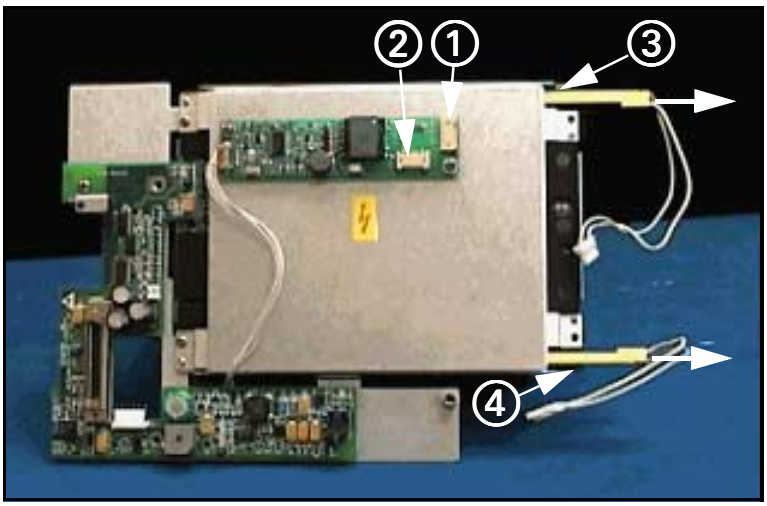

Figure 3-9 Backlight Retaining Tabs Location

5.9 TFT-LCD Display Backlight Replacement

Always replace both backlights, even though only one may be defective, to assure even lighting of the display screen.

Removing Backlights

1. After removing TFT-LCD Display Subassembly from monitor (refer to Section 5.5), and with back of TFT-LCD display facing up as shown in Figure 3-8, unplug cable connectors from X1 and X2 (① and ② in Figure 3-8 and Figure 3-9).
2. Depress each black plastic retaining tab, ③ and ④ in Figure 3-9, and extract corresponding backlight from TFT-LCD display guide slot in direction indicated by heavy arrows in Figure.

Installing Backlights

3. Slide new backlights into TFT-LCD display guide slots until retaining tabs snap into position.
4. Plug backlight cables into X1 and X2 (① and ② in Figure 3-8 and Figure 3-9).
5. Reverse steps of Section 5.5.2 to reinstall TFT-LCD Display Subassembly and reassemble monitor.

5.10 PODPORT PC Board Removal/Installation

The following is a procedure for removal/installation of a PODPORT PC Board without requiring that the TFT-LCD Display Subassembly be removed from the Monitor. If installing the PODPORT Option into a monitor that did not have the option previously installed, slide the insert out of the PODPORT connector channel in left side of Intermediate Subassembly and discard before attempting to install the PODPORT connector sleeve.

5.10.1 Removing PODPORT PC Board

1. After removing Front Bezel (refer to Section 5.2), place monitor backside down on clean flat surface.

To view the process, click on the picture.

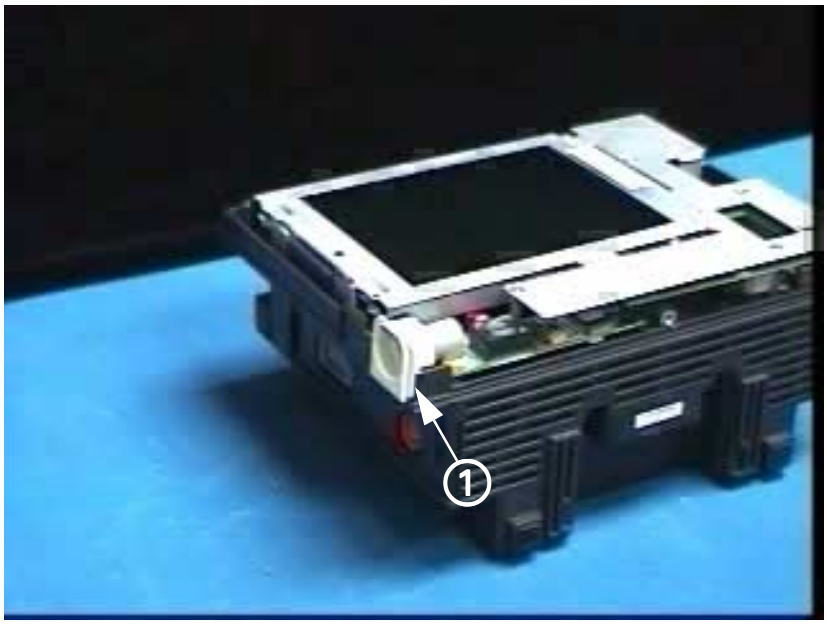

Figure 3-10 Removing PODPORT PC Board

2. Carefully insert side panel removal tool between port sleeve and chassis, as shown in Figure 3-10.

   Note: This releases latching tab on the bottom of sleeve, enabling sleeve to slide up and out of side of Intermediate Subassembly.

3. Apply upward pressure on sleeve to slide sleeve off of PODPORT connector and out of opening in side of Intermediate Subassembly.

   Note: When sliding port sleeve onto PODPORT connector during reassembly, be sure that tab on bottom of sleeve engages Intermediate Subassembly frame to lock sleeve into place.

4. Remove and save screws as shown in Figure 3-10.
5. Depress Front Panel PC Board securing tab, using side-panel removal tool, and gently lift up simultaneously on metal plate and circuit board to free board from latch and to unplug Front Panel PC Board connector from connector on PODPORT PC Board.
6. Lift and slide PODPORT PC Board out of Monitor.

5.10.2 Installing PODPORT PC Board

1. With Front Bezel removed (refer to Section 5.2), and monitor backside down on clean flat surface, remove screws as shown in Figure 3-10 (if not already removed) to free Front Panel PC Board and metal plate.
2. Depress Front Panel PC Board securing tab, using side-panel removal tool, and gently lift up simultaneously on metal plate and circuit board) to free circuit board from retaining clip.
3. Locate PODPORT PC board on positioning posts on Intermediate Subassembly.
4. Carefully align Front Panel PC Board connector into connector on PODPORT PC Board, and press on metal plate and Front Panel PC Board to secure board under latching tab.
5. Slide PODPORT connector sleeve into access slot in left side of Interface Subassembly.

6. Reinstall screws removed in step 4 of Section 5.10.1 above.
7. Refer to Section 5.5.2 to reinstall TFT-LCD Display Subassembly and reassemble monitor.

To view the process, click on the picture.

Figure 3-11 Removing Intermediate Subassembly

5.11 Replacing Intermediate Subassembly

The Intermediate Subassembly constitutes a framework for positioning the TFT-LCD Displaly Subassembly, and shields the Front Panel Subassembly and associated circuitry from the Main Processor, While the Intermediate Subassembly needs to be removed to access components of the rear housing, normally the subassembly should need to be replaced only if it becomes physically damaged.

5.11.1 Removing Intermediate Subssembly

1. After removing TFT-LCD Display Subassembly (see Section 5.5) and PODPORT PCB, place rear housing subassembly back side down on a clean flat surface (open side up).
2. Remove 6 screws and save for use in reinstallation. See Figure 3-11.

   Note: Screws are of different sizes. Identify screws removed so that each can be reinserted into the same position during reassembly.
3. Insert blade of side-panel removal tool into four slots in sides of rear housing to release latches that secure intermediate subassembly in rear housing.
4. Apply firm pressure between rear housing and external flange on Intermediate Subassembly to separate subassembly from housing.
5. Place Intermediate Subassembly safely aside for use in reassembly.

5.11.2 Installing Intermediate Subssembly

1. Place rear subassembly on a clean flat surface so that the Main Processor Subassembly is facing up.
2. Reverse procedure of Section 5.11.1 to install Intermediate Subassembly.

5.12 Replacing Main Processor Subassembly

5.12.1 Removing Main Processor Subassembly

The main processor PC board is sandwiched between metal shields and a heat sink, which altogether constitute the Main Processor Subassembly.

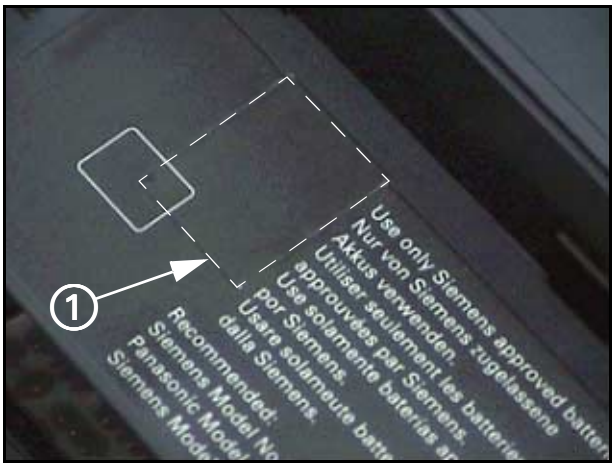

Figure 3-12 Securing Screw Access Cover

1. With Intermediate Subassembly removed from rear housing (refer to Section 5.11), remove and save screw (located in back of battery compartment under label, ① in Figure 3-12) that secures Main Processor Subassembly in rear housing.
2. Place rear housing normal side down with its open side facing you, as shown in Figure 3-13.
3. Carefully pull NBP tubing off of port on NBP transducer on main processor board as shown in Figure 3-13.

To view the process, click on the picture.

Figure 3-13 Accessing Main Processor Subassembly

4. Carefully separate Main Processor Subassembly from rear housing on left side as shown, and then lift plastic funnel off of subassembly and store for future reinstallation.

Note: The memory card ejector shaft (③ in Figure 3-13) must be pushed in all the way when removing the Main Processor Subassembly from the rear housing.

5. Reach behind subassembly and carefully pull NBP tubing all the way back through hole in main processor board.
6. Unplug ground connector (① in Figure 3-14) above hole through which NBP tubing was removed), to permit better access to cable connectors plugged into main processor board.
7. As carefully as you can in the limited area of access, unplug red/black/white main power cable connector (② in Figure 3-14), 2-wire black/white NBP engine pump cable in 3-pin connector (③ in Figure 3-14) , 4-wire black/white/black/white valves cable in 4-pin connector (④ in Figure 3-14), and 4-wire red/orange/yellow/black ID chip cable in 5-pin connector (⑤ in Figure 3-14) from main processor board.
8. Separate Main Processor Subassembly out of rear housing and set aside in static protected environment.

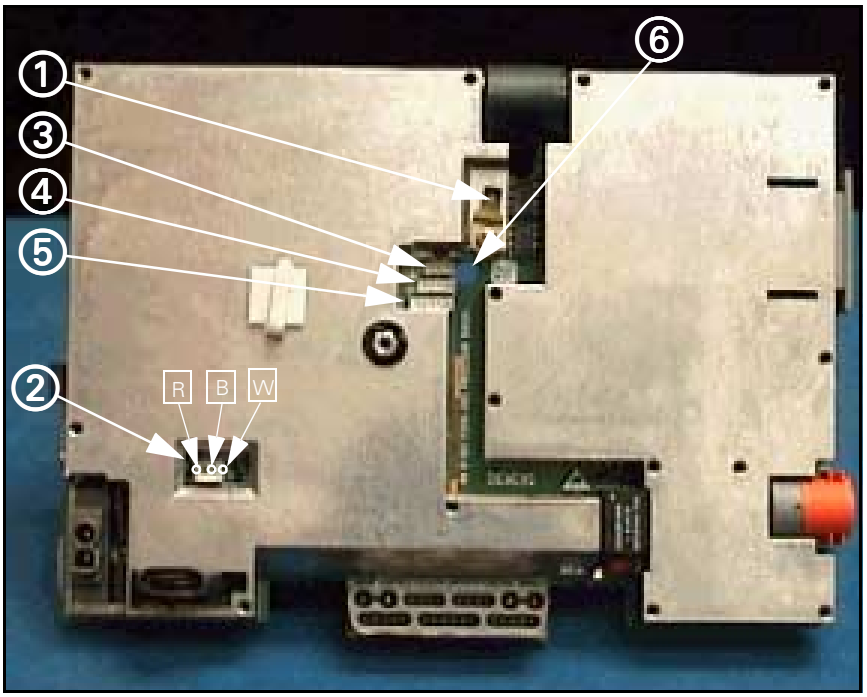

Figure 3-14 Connector Locations on Main Processor Subassembly

5.12.2 Installing Main Processor Subassembly

1. With monitor positioned as in Figure 3-13, as carefully as you can in limited area of access, plug in red/black/white main power cable connector.

Caution

Observe proper polarity to avoid damage to the Main board. Refer to Figure 3-14. Orient the connector so that the red wire plugs into R and the black wire into B.

2. Then plug in following cables into main processor PC board connectors in sequence listed. Refer to Figure 3-14.

a) 4-wire red/orange/yellow/black ID chip cable in 5-pin connector (⑤)

b) 4-wire black/white/black/white valves cable in 4-pin connector (④)

c) 2-wire black/white NBP engine pump cable in 3-pin connector (③)

d) ground cable connector into terminal lug (①) above hole for NBP tubing

3. Dress cables through cable restraint on back of Main Processor Subassembly.
4. Route NBP tubing through hole provided in main processor board (⑥ in Figure 3-14).
5. Install funnel on top of Main Processor Subassembly so that positioning flanges are inside spacers on metal shield on main processor board, and channel is fully seated in channel guide along top of both metal shields.
6. Tuck ferrite on power cable into cavity in lower right back of rear housing. (See ③ in Figure 3-20 on page 43.
7. Carefully position Main Processor Subassembly in rear housing.

   Note: When properly positioned, by funnel and shield around Docking Station Connector, Main Processor Subassembly slides easily into rear housing. **Do not try to force Subassembly into housing**.
8. Pull gently on air hose to take up any slack and connect end of hose to transducer on main processor board.
9. Holding Processor Subassembly firmly in position in rear housing, turn housing over and secure subassembly to housing using screw removed in step 1 of Section 5.12.1.
10. Install replacement label over securing screw in battery compartment.

    Note: Installation of a replacement Main Processor Subassembly requires that the hardware revision number stored in EEPROM in the monitor be corrected. Refer to Section 5.17 for the procedure.
11. Refer to Section 5.11.2 to install Intermediate Subassembly and reassemble Monitor.

5.13 Monitor Handle

5.13.1 Removing Handle

Remove the handle as follows:

1. With Main Processor Subassembly removed from rear housing, place housing backside down on clean flat surface. See Figure 3-15
2. Insert common-blade screwdriver or flat end of side panel removal tool sequentially into each of two slots, ③ and ④ in Figure 3-15, as you apply a slight downward pressure on handle (see arrow).

   Note: This releases the locking tabs on the bottom of the plate, and pressure on the handle lifts and holds up bottom edge of plate.
3. Using your fingers, lift up bottom edge of plate enough to fully release locking tabs.
4. Pull on retainer plate to draw tabs on top of plate out of handle shaft holes in top of rear housing and remove it.
5. Pull handle out through top of housing.

To view the process, click on the picture.

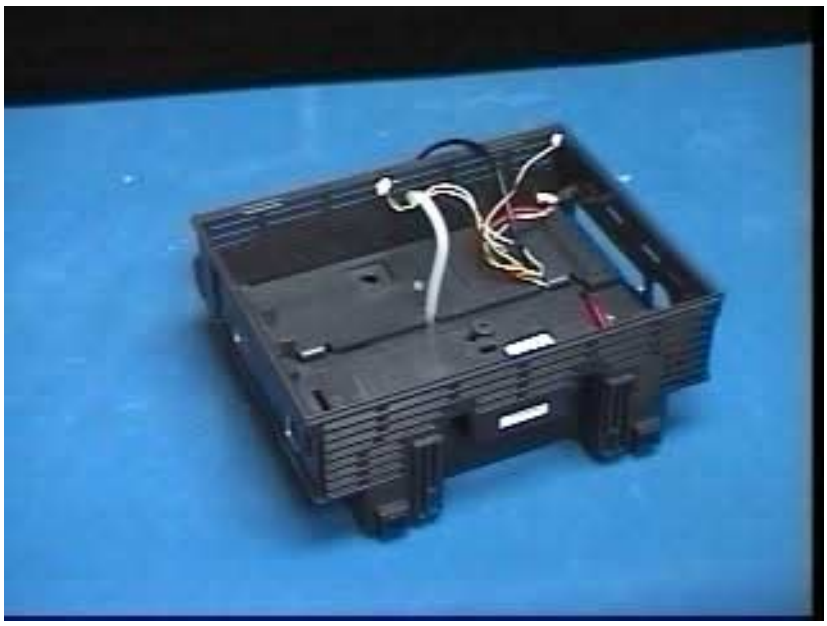

Figure 3-15 Removing Handle retaining Plate

5.13.2 Installing Handle

1. Insert handle through slots in top of housing, so that smooth sides of handle shafts ride on channels in housing (rectangular locking pads on shafts should be visible).
2. Route cables from ID chip and from NBP subassembly through slot provided beside bottom right-hand locking tab in retainer plate.
3. Route main processor board transducer air hose from NBP sub-assembly through slot provided at bottom of retainer plate .
4. Slide plate's top tabs into handle shaft holes on top of handle shafts and press bottom tabs into slots in rear housing to lock plate in position.

   Note: Tilt the handle slightly to permit the plate's top tabs to be inserted easily.
5. Refer to Section 5.12.2 to reinstall Main Processor Subassembly and reassemble monitor.

To view the process, click on the picture.

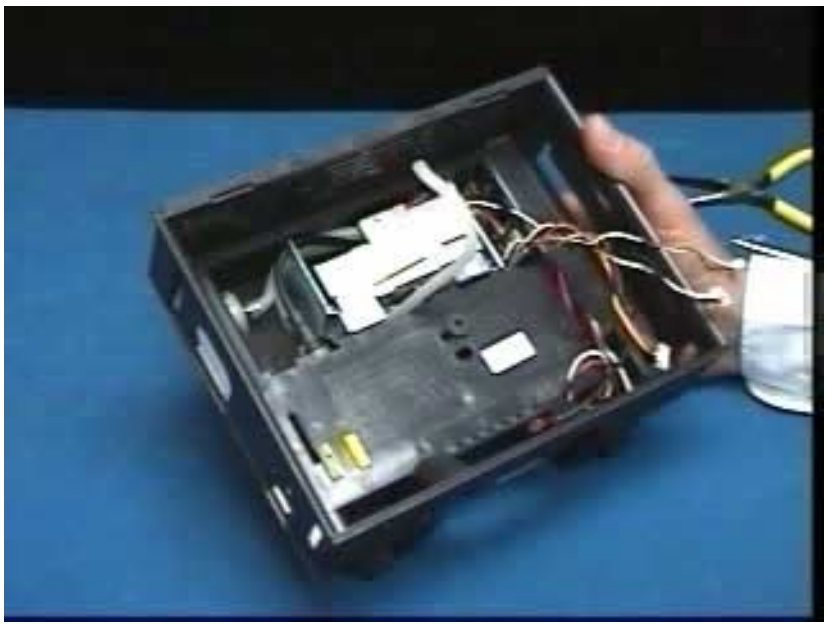

Figure 3-16 Location of NBP Subassembly in Rear Housing

5.14 Replacing NBP Subassembly

Replacing the NBP subassembly invalidates pneumatic tolerance values previously stored. Replacing this subassembly, therefore, involves the following steps:

a) Replace NBP Subassembly, and reassemble monitor.

b) Check for leaks in pneumatic system

c) Calibrate NBP Function in Monitor

d) Characterize pneumatic tolerances

5.14.1 Removing NBP Subassembly

Refer to Figure 3-16. Remove NBP Subassembly as follows:

1. Remove Main Processor Board Subassembly (refer to Section 5.12.1). and handle-retaining plate (Section 5.13.1).
2. Slide air intake filter out of its retaining slot in top of battery compartment in rear housing.
3. Slip NBP air hose off of metal cuff connector.
4. Slide NBP Subassembly partially out of its cavity in rear housing, and unplug ID chip ground connector.
5. Slide NBP Subassembly completely out of rear housing.

5.14.2 Installing NBP Subassembly

1. Dress pneumatic tubing of NBP subassembly as shown in Figure Figure 3-18 on page 42, and slide subassembly into guide channels in NBP cavity of rear housing.

   Note: Route transducer hose behind cuff connector hose and then through hole in lower section of assembly so that the hose exits under manifold subassembly as in Figure 3-16. Position air intake hose beside cuff connector hose. Ensure all hoses are not constricted or pinched when sliding NBP Subassembly into place in cavity in rear housing.

2. Partially slide NBP subassembly into guide channels in rear housing, and reconnect ID chip ground wire to ground connector on NBP Subassembly.

3. Be sure wires of pump and valve cables are not trapped behind or under NBP subssembly guides, and seat NBP Subassembly completely into NBP cavity in rear housing.
4. Secure NBP air hose onto metal cuff connector in side of rear housing.
5. Slide air intake filter into retaining slot in top of battery compartment of rear housing.
6. Route transducer hose through access slot in bottom of handle retainer plate.
7. Dress cables from I/O chip, NBP and ground cable through slot provided in retainer plate and reinstall plate (see step 4 in Section 5.13.2).
8. Refer to Section 5.12.2 to reinstall Main Processor Subassembly and reassemble monitor.

5.15 Replacing NBP Air Filters

There are two NBP air filters -- an air intake filter (② in Figure 3-16 and in Figure 3-18, also see ① in Figure 3-17), and a manifold filter (① in Figure 3-18). The first is accessible from the top of the battery compartment; and does not require that the monitor be opened. The second is located in the manifold subassembly itself.

Figure 3-17 NBP Air Intake Filter Access

5.15.1 Replacing Air Intake Filter

1. Open battery compartment door and remove battery.
2. Remove plastic cap covering air intake filter (① in Figure 3-17) through opening in top of battery compartment as shown in Figure 3-17.
3. Remove filter with a pair of needle-nose pliers.
4. Fully insert new filter into filter housing, open end first, and replace cap.

   Note: NBP filters have an opening in one end. The end with the opening must be inserted into the filter housing for the filter to function properly.
5. Reinstall battery and battery compartment door.

To view the process, click on the picture.

Figure 3-18 NBP Manifold Filter Replacement

5.15.2 Replacing Manifold Filter

It is necessary to open the monitor and remove the Main Processor Subassembly to access the NBP Subassembly and replace the manifold filter. Replace the filter as follows:

Note: Replace manifold filter only if monitor fails characterization.

1. With Main Processor Subassembly removed from rear housing (see Section 5.12.1), slide NBP Subassembly partially out of rear housing to access manifold filter.

   Note: It is not necessary to completely remove NBP Subassembly from rear housing, as shown in Figure 3-18, if only replacing filter.

2. Remove plastic cap covering manifold filter.
3. Remove manifold filter with a pair of needle-nose pliers as shown.
4. Fully insert new filter (see Note in step 4 above), and replace cap.
5. Reinstall NBP Subassembly. Refer to Section 5.14.2.

5.16 Replacing Battery Connector Subassembly

1. Open Monitor and remove Main Processor Subassembly (refer to Section 5.12.1).
2. With battery compartment door and battery removed, disconnect inline battery connector (② in Figure 3-19) from battery terminal connector (① in Figure 3-19) in battery compartment.

   Note: The battery terminal connector subassembly (① in Figure 3-19) is inserted into the battery compartment from inside the rear housing, through an opening in the back of the rear housing (⑤ in Figure 3-19 and in ② in Figure 3-20), and held in place by the spring action of two locking tabs (③ in Figure 3-19).

3. Slide a thin metal wedge, such as a small flat-blade screwdriver, between locking tab and battery connector subassembly (see ④ in Figure 3-19) on each side as you press subassembly into rear housing.

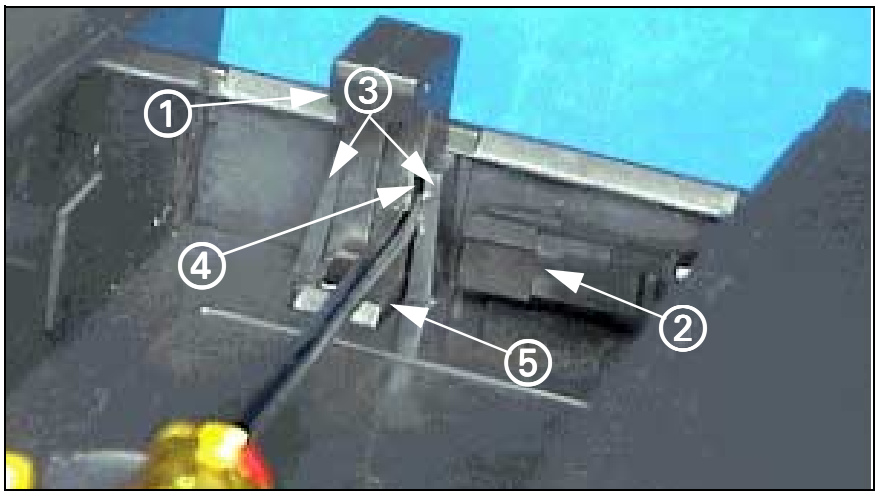

Figure 3-19 Battery Connector Subassembly

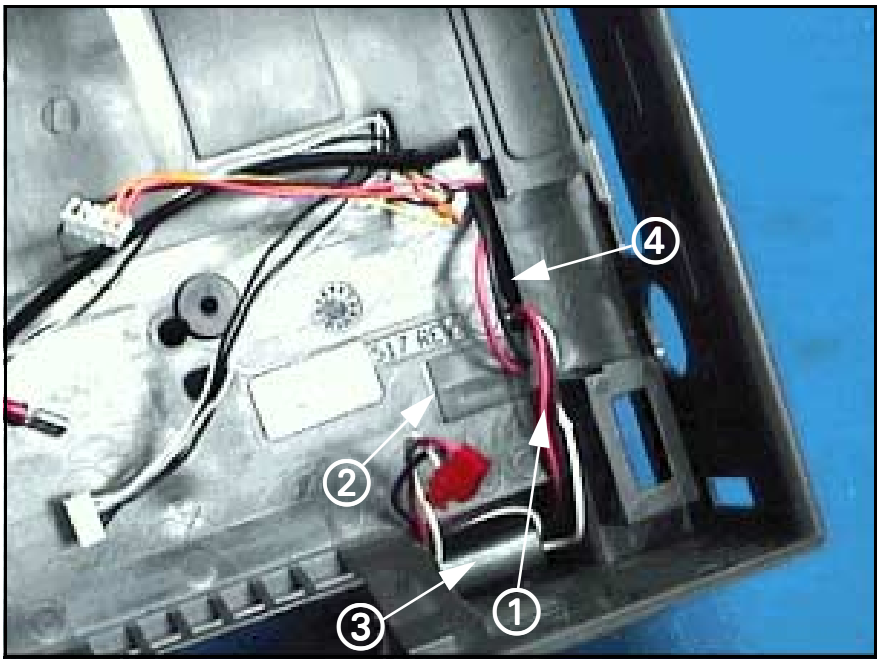

Figure 3-20 Battery Connector Subassembly Access Inside Rear Housing

Note: Figure 3-19 shows right hand locking tab wedged open (④ in Figure 3-19). Pressing on the top of the subassembly keeps the right hand locking tab unlocked while you wedge left hand tab open.

4. Remove power cable (① in Figure 3-20) from inside rear housing assembly.
5. Insert replacement power cable (① in Figure 3-20) into rear housing assembly, ensuring female in-line battery connector enters battery compartment through opening in rear housing (④ in Figure 3-20).
6. Position ferrite on power cable (③ in Figure 3-20) into cavity in lower right hand back of rear housing.
7. From inside of rear housing (Figure 3-20), insert battery terminal (① in Figure 3-19) through opening in rear housing (② in Figure 3-20 and also ⑤ in Figure 3-19).

8. Squeeze locking tabs (③ in Figure 3-19) in battery compartment together while pressing on battery connector from inside rear housing to lock replacement battery connector subassembly in place.
9. Reinstall Main Processor Subassembly (refer to Section 5.12.2) and reassemble monitor.

5.17 Correcting Hardware Revision Number Stored in Monitor

The terminal emulation program in a laptop or PC equipped with Microsoft® Windows 3.1, Win95, or other equivalent terminal emulator, is required to correct the hardware revision number stored in EEPROM in the monitor. In addition, Diag UART cable Art. No. 47 14 346 E530U is also required. Use the following procedure to enter the correct hardware revision into EEPROM.

Connect diagnostic cable, CBL DIAG UART 47 14 346 E530U, into serial port on PC/laptop. If PC/laptop is equipped with Windows 3.1, go on to Section 5.17.1. If PC/laptop is equipped with Windows 95, go to Section 5.17.2.

5.17.1 Windows 3.1

1. On PC/laptop computer, double-Click on Accessories window.
2. Double-click on Terminal Icon.
3. Select Settings, and then Communications.
4. Set following parameters as given, and click on OK.
   - Connector: Com **X** (**X** = PC/laptop serial port to which diagnostic cable is attached)
   - Baud: 19200
   - Data bits: 8
   - Stop bit: 1
   - Parity: none
   - Flow Control: none
   - Parity Check: leave blank
   - Carrier detect: leave blank
5. Press <Enter> and proceed to Section 5.17.3.

5.17.2 Windows 95

1. Select "Start" and scroll to "Programs", then "Accessories", then "Hyperterminal".
2. At "Hyperterminal" window, select "Hypertrm.exe" icon.
3. If asked to set up for modem use, select NO.
4. At "Connection Description" window, enter **SC6002XL** in "Name" box, select any icon, and select OK.
5. At "Phone Number" window, "Connect using:" box pull-down menu, select **Direct to Com X** (**X =** serial port on PC/laptop to which diagnostic cable is attached) and click on OK.
6. At "Com X Properties" window, set following parameters and click OK.
   - Bits per second: 19200
   - Data bits: 8
   - Parity: none
   - Stop bit: 1
   - Flow Control: none
7. Press <Enter> and go on to Section 5.17.3.

5.17.3 Procedure

1. Do either of the following as required:
   - If monitor equipped with interface plate, plug other end of cable into X7 on interface plate.
   - If monitor mounted on docking station or INFINITY Docking Station, plug other end of cable into X3 on CPS or IDS.
2. Plug in monitor power adapter and power-up monitor.
3. After *MAIN* screen displays on monitor, press <Esc> on PC/laptop keyboard.

SC6002XL SUPPORT MENU

00) Error Display	01)Event Log
02) Database Defaults	03)Real-time Clock
04) Set EEPROM H/W Rev.	05)Set NBP Constants
06) Verify NBP Constants	07)Display Service Data

Press ENTER to exit

Figure 3-21 Support Menu (Item numbers may differ in different versions of installed software.)

4. When "Enter Password" prompt displays, type in **7412** and press <Enter> to bring up SC6002XL SUPPORT MENU (See Figure 3-21).
5. Type in **4** and press <Enter> to select "Set EEPROM H/W Rev."

   Note: A message displays H/W Rev. presently stored in EEPROM. If H/W Rev. indicated is same as on Rev. label located on replacement board between RFI shield and heat sink, type **N** at next prompt to exit program.
6. At "Update hardware revision (<Y>es or <N>o)" prompt, type in **Y** or **N** as required.
7. Type in major hardware revision number (numerical part of H/W Rev.) from label on replacement board.
8. Type in minor hardware revision letter (alphabetical part of H/W Rev.) from label on replacement board.
9. Press <Enter> to exit program.

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Chapter 4: Functional Verification and Calibration

1 Functional Verification Tests

Complete the following Functional Verification Tests. Document test results on a copy of the Functional Checklist in Appendix D: Functional Verification Checklist.

1.1 Power Circuits and Startup

The following procedures check the monitor's power circuits, power-up sequence, and power off indicator. Begin this procedure with monitor turned off, main battery removed, and ac power adapter disconnected.

AC Power Adapter

1. With power cord connected to a hospital-grade power source, plug ac power adapter into monitor.
2. Verify that green Battery Charger LED on front panel of monitor illuminates.

Power-Up Sequence

3. Press ON/OFF switch on front panel, and verify following sequence of events:
   - 3.1) Power ON LED in ON/OFF key turns on, display illuminates and monitor emits a brief tone.
   - 3.2) Startup screen containing displays character changing colors as it descends towards Siemens Logo.
   - 3.3) Monitor emits a brief tone and screen goes blank for a few seconds.
   - 3.4) Pressure relief valve pulses.
   - 3.5) Display reappears containing Siemens copyright notice, installed software version, and message "Loading software, please wait...".
   - 3.6) *MAIN* screen replaces Startup Screen after several seconds.

Power Off Indicator

4. Press ON/OFF switch, and verify that monitor powers-down and a high pitched tone sounds for ≈ 7 seconds.
5. Disconnect external power source from monitor, and verify that Battery Charger LED turns off.

Battery and Charging Circuit

6. Install main battery.

   Note: Battery should have at least 50% charge level, as indicated by the charge level bar graph in the display message area.
7. Press ON/OFF switch on front panel, and verify the following:
   - Monitor powers-up according to normal power-up sequence of events. (Refer to power-up sequence in step 3.)
   - Battery charge level indicator appears in message field on bottom left hand side of display.
8. Plug in ac power adapter, and verify that the Green Battery Charger LED on front panel of monitor illuminates, screen brightness increases, and after ≈ 14 seconds, charge level indicator disappears.

1.2 Optical Encoder

The Rotary Knob on the front panel controls an optical encoder for pointing to and selecting fields and functions on the display.

1. After power-up sequence has completed, press Rotary Knob and verify that fill color of New Patient NO prompt changes to white indicating that you can now confirm value NO or change it to YES.

2. Turn knob one notch (detent, click) in either direction, and verify that value in NO field changes to YES. Turn knob another notch, and verify that value changes back to NO.
3. Choose YES, and verify that New Patient prompt disappears.

1.3 TFT-LCD Display

The SC6002XL display is composed of an active-matrix, 6.5 inch TFT-LCD screen with backlite. Test the TFT-LCD display as follows:

1. Verify that backlite provides sufficient and consistent background illumination for TFT-LCD.
2. Verify that there are ≤ 17 inoperative pixels ("stuck" ON or OFF).

1.4 Fixed Keys

The following tests verify that membrane switches on the front panel are functioning properly, and that the signal from the key is processed by the Front Panel Control PCB.

Note: Before beginning Key tests access Main menu. Select Monitor Setup → Monitor Options → Speaker Volumes, and assure that Attention Tone Volume is set to other than OFF.

ON/OFF Key

The ON/OFF key initiates the power-on sequence if the monitor is powered off, and powers-off the monitor, initiating a brief power-off piezo alarm, if the monitor is powered-on.

Note: This test can be omitted if the procedure in step 3 of Section 1.1 has already been performed.

1. Press and momentarily hold ON/OFF key.
2. Verify that powered state of monitor changes from ON to OFF or from OFF to ON.
3. Set monitor to powered-on state, if monitor powered off.

Main Screen and Menu Keys

The Main Screen key sets the display to the *MAIN* screen.

4. Press Menu key to display Main menu.
5. Press Main Screen key, and verify that Main menu extinguishes, and display returns to *MAIN* screen.

Alarm Silence Key

The Alarm Silence key silences an alarm tone for one minute.

6. Assure that HR alarm is enabled, and without any input applied to MultiMed POD, plug MultiMed or MultiMed 6 cable into monitor. Monitor should Alarm.
7. Press Alarm Silence key and verify that alarm ceases.

Alarm Limits Key

The Alarm Limits fixed key calls up a setup table on which upper and lower alarm limits for physiologic parameters can be assigned, and alarms and alarm recordings can be enabled or disabled.

8. Attach patient simulator to MultiMed cable and set simulator as follows:
   - ECG = Normal Sinus
   - HR = 60 beats per minute (bpm)
9. With *MAIN* screen displayed, press Alarm Limits fixed key.
10. Verify that Alarms Setup Table displays.
11. Set Upper HR alarm parameter to 55.

All Alarms Off Key

The All Alarms Off key silences all alarms for a period of 3 minutes.

12. When alarm sounds (setup in previous step),press All Alarms Off key.
13. Verify message "All Alarms Off" appears on display.
14. Verify that after 3 minutes, alarm sounds and "All Alarms Off"message disappears.
15. Set alarm parameter within alarm condition (> 60).

Record Key

The Record key initiates a recording when monitor is connected, either directly or via a network, to an R50 Recorder and otherwise initiates a stored recording.

16. Press Record key.
17. Verify "Recording Started" appears in message field.

NBP Start/Stop Key

The NBP Start/Stop key initiates or terminates the inflation cycle for the non-invasive blood pressure monitor function.

18. Press Menu key. Access Monitor Setup → Monitor Options → Speaker Volume → Medium.
19. Press NBP Start/Stop key.
20. Verify that monitor sounds a tone. (Cuff must **Not** be plugged into cuff connector.)

Zoom Key

The Zoom key allows NBP data displayed in either large characters across the bottom of the SC6002XL display or in a small parameter box in the lower right section of the display. Displaying NBP in the small parameter box allows 3 additional parameter boxes to be available across the bottom of the display.

21. Press Zoom key, Access Bottom Channel → All.
22. Verify that 4 parameter boxes displayed across bottom of display.
23. Access Bottom Channel → NBP.
24. Verify NBP parameter boxes across bottom of display

1.5 ECG/RESP

ECG/RESP Test Setup

1. Connect either a 3-lead, 5-lead, or 6-lead ECG cable from the Patient Simulator into the MultiMed POD.
2. Select HR parameter box and press rotary knob in to bring up ECG menu.
3. Set all ECG Lead settings at default values and remaining parameters as follows:

- Tone Source ECG
- Tone Volume Low
- Pacer Detection On
- QRS Marks On
- ECG Processing ECG1
- ECG Leads (set for type cable installed in step 1)
- Arrhythmia On
- Relearn depress knob to update Arrhythmia

4. Set simulator as follows:
   - ECG = Normal Sinus
   - HR = 80 beats per minute (bpm)
   - amplitude = 1.0 mV
   - RESPIRATION = Normal Rest.
   - rate = 20 breaths per minute (BPM)
   - ohms = 1.0
   - LEAD SELECT = II/RA-LL
   - BASELINE IMPEDANCE = 500

Waveforms/Digital Readouts/Tones

1. Verify the following:
   - Waveform and HR correspond to data provided by simulator.
   - Heart symbol (♥) blinks and pulse tone sounds for each QRS complex.
   - White spike present at each QRS complex.
   - RESP and HR digital readout correspond to settings of simulator.
2. Vary Tone Volume setting and verify that pulse tone volume changes.
3. Set Tone Volume to OFF, and verify that pulse tone stops.

Lead-Off Indicators

1. One at a time, disconnect each ECG lead from simulator.
2. Verify "Lead-Off" message appears in message area, pulse tone ceases, and *** replaces digital heart rate in HR field for each lead removed in step 1.
3. Reconnect all leads to simulator.

Alarm Function

This procedure also tests that the alarm function of the monitor, as applicable to all other patient parameters, is operational in the monitor.

1. In Alarm Limits Table, set HR alarm parameters as follows:
   - Upper limit = 110 bpm
   - Lower limit = 40 bpm
   - Alarm = ON
2. Set simulator to HR = 120 bpm.
3. Verify that monitor responds with following Serious Alarm indications:
   - HR in parameter field = 120
   - HR parameter field blinks and color changes.
   - Serious Alarm tone sounds.
   - Message HR > 110 appears in message area at bottom of display.
4. Reset simulator to HR = 80 bpm.
5. Verify the following:
   - HR parameter field returns to normal color
   - HR returns to 80
   - Message area continues to report cause of most recent alarm

6. Press Alarm Silence fixed key.
7. Verify that "HR > 110" ceases to be reported.

1.6 Asystole

Switch power to simulator OFF. Verify that HR parameter field reports ASY, "Asystole" appears in message area at bottom of display, and monitor responds with Life-Threatening alarm.

Switch power to simulator ON.

1.7 SpO_2

The SC 6002XL monitors oxygen saturation (SpO_2) and pulse rate using the spectrophotometric method. SpO_2 software is checked on monitor power-up and also periodically while the monitor is in operation.

SpO_2 Test Setup

1. Select SpO_2 parameter box to access menu. Set parameters as follows:
   - Pulse Tone Source SpO_2
   - Pulse Tone Volume Low
   - Bargraph ON
   - Averaging Normal
2. On Main Screen, highlight Channel 2 field and access menu. Set parameters as follows:
   - Curve SpO_2
   - Size 20-30%
3. Apply SpO_2 sensor to finger.
4. Verify an SpO_2 reading of $\geq$ 94 in the monitors SpO_2 parameter box.

   Note: Allow approx. 20 seconds for reading to stabilize.

Waveforms/Digital Readouts/Tones

1. Verify the following:
   - Channel 2 displays SpO_2 waveform, and digital SpO_2 and pulse rate (PLS) values.
   - Pulse strength bar graph pulses SpO_2 in field, ♥ symbol blinks in PLS field, and pulse tone sounds for every detected pulse.

1.8 Temperature

Using the Temperature Y Cable input to the MultiMed Pod, set up the patient simulator to supply a temperature input.

1.8.1 Functional Verification Procedure

Set the simulator for a standard 37°C.

1. Verify that monitor indicates temperature of 37±0.1°C.
2. Change simulator to temperature above and then below 37°C.
3. Verify that monitor readout agrees with simulator settings ±0.1°C.
4. Perform Temperature Calibration Check, if required by local Regulatory Standards.

1.8.2 Temperature Calibration Check

In some national jurisdictions temperature calibration must be checked periodically as specified in the Operating Instructions or User Guide (at least every two years). Use the following procedure.

Recommended Equipment

Decade Resistor with ±0.1% accuracy (or fixed resistors with same accuracy)

Siemens Temp Adapter Cable, Art. No. 51 98 333 E530U (Optional)

Procedure

1. Connect MultiMed pod to input of patient monitor.

2. Connect temp adapter cable to MultiMed Pod (if needed).
3. Connect temperature input to decade resistor.

Table 4-1Resistance Value vs. Temperature

Resistance Setting (Ω)	Set Temperature	Monitor Reading	Tolerance	Pass
6990	1.0		0.9 to 1.1	
3539	15.0		14.9 to 15.1	
1355	37.0		36.9 to 37.1	
843.2	49.0		48.9 to 49.1	

4. For each resistance value in Table 4-1, verify that monitor reports "Set Temperature" value ±0.1°C.
5. Document test results on a copy of the Functional Verification Checklist in Appendix D.

1.9 $etCO_2$ (if installed)

The $etCO_2$ Pod enables the SC6002XL to non-invasively monitor end-tidal CO_2 ($etCO_2$) using a technique that relies on the selective absorption properties of CO_2 to specific frequencies of infrared radiation. The pod automatically compensates for variations in ambient barometric pressure if set to automatic mode. Before beginning this procedure, use a mercury column barometer or equivalent other device to determine local atmospheric pressure. Record this value_____.

1. Press Main screen key.
2. Connect Sensor (without adapter) to $etCO_2$ pod and pod to monitor.

   Note: Observe"etCO2 Sensor Warming Up" in message field at bottom of monitor.
3. After "etCO2 Sensor Warming Up" disappears (approximately 2 minutes), select $etCO_2$ parameter box and in $etCO_2$ setup menu select "More".
4. Select Atm. Press Mode - Manual.
5. Select Atm Pressure and set value as recorded above.
6. Press Main Screen key.
7. Select $etCO_2$ parameter box and in $etCO_2$ Setup menu, select "Sensor Cal.".
8. After "etCO2 Place Sensor On Zero Cell" appears at bottom of screen, place sensor on Zero Cell.
9. Verify "etCO2 Calibrating Sensor" appears in message field, followed by "etCO2 Place Sensor on Ref Cell".
10. After "etCO2 Place Sensor on Ref Cell" appears, place sensor on Reference Cell.
11. Verify that"etCO2 Verifying Sensor Cal", appears, then "etCO2 Sensor Cal Verified" appears simultaneously with a tone.
12. Verify reading in etCO2 parameter box = 38 ±2mmHg.
13. Remove reference cell, insert adaptor into sensor and press Main Screen key.

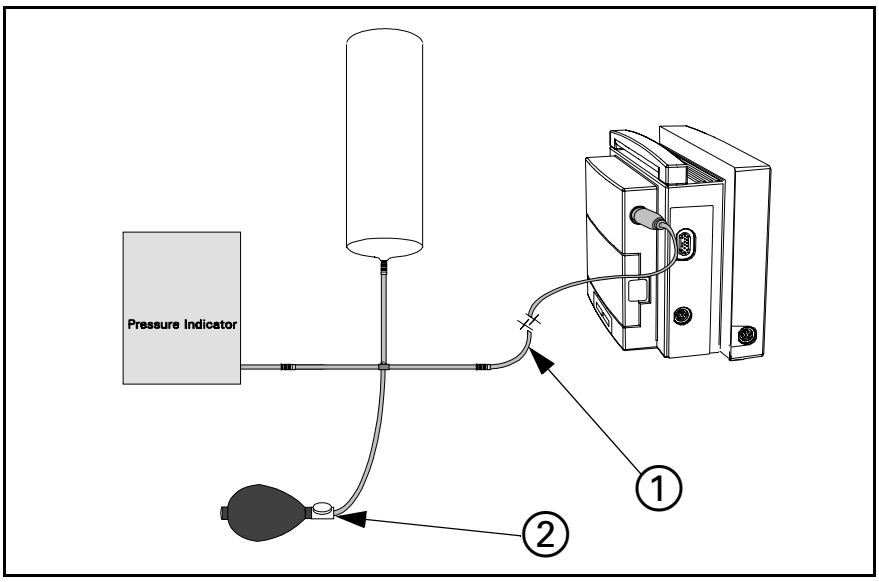

Figure 4-1 Test Setup

1.10 Non-Invasive Blood Pressure

1.10.1 System Setup and Pneumatics Leakage Test

Set up NBP Calibration assembly (Art. No. 28 77 855 EE54U) as illustrated in Figure 4-1. Assure that pneumatic leakage is within specifications before continuing to Section 1.10.2, Calibration Check.

1. Power-up monitor.
2. After *MAIN* screen displays on monitor, double-click rotary knob to accept "New Patient".
3. Turn rotary knob until NBP field is highlighted, then depress knob.
4. Set following in NBP parameter field menu:
   - Interval Mode: OFF
   - Calibration Mode: ON (Observe "NBP Cuff 0 mmHg" appears in lower right area of NBP field
   - Inflation Mode: Adult:270
5. Clamp pneumatic hose (with hemostat or clamp) between T-connector and monitor (① in Figure 4-1), and using pressure bulb, increase pressure to 250 ±5 mmHg. Then clamp hose at inflation bulb (② in Figure 4-1), and let pressure stabilize for 1 minute. *Do NOT run pump.*
6. Observe pressure drop for an additional 5 minutes. Drop should be <2 mmHg in 5 minutes. If not, tighten all connections and fittings and retest equipment for leakage. When leakage test OK, go on to step 7.
7. With both clamps removed, reinflate to 250±5 mmHg, if necessary, and then re-clamp hose at inflation bulb.
8. Observe pressure drop for 1 minute. Drop should be <4 mmHg. If not, service monitor's internal pneumatics system and retest system for leakage. When leakage test OK, remove clamp at inflation bulb and go on to Section 1.10.2.

1.10.2 Functional and Calibration Check

1. Using hand bulb, increase pressure to 250 ±5 mmHg, if necessary, and allow it to stabilize for 1 minute.

2. Verify that pressure values displayed on monitor (lower left message area) and pressure indicator are within ±3 mmHg of each other.
3. Slowly release pressure in decrements of 50 mmHg. At pressures of 200, 150, 100, and 50 mmHg, verify that pressure values on monitor and pressure indicator are within ±3 mmHg of each other at each level.
4. If NBP function fails calibration check, go to Section 3 and calibrate NBP system. Then return to step 5. Otherwise, if NBP function is OK, Set Calibration Mode to "OFF" as described in steps 3 and 4 of Section 1.10.1 and continue.
5. Document test results on a copy of Functional Verification Checklist in Appendix D.

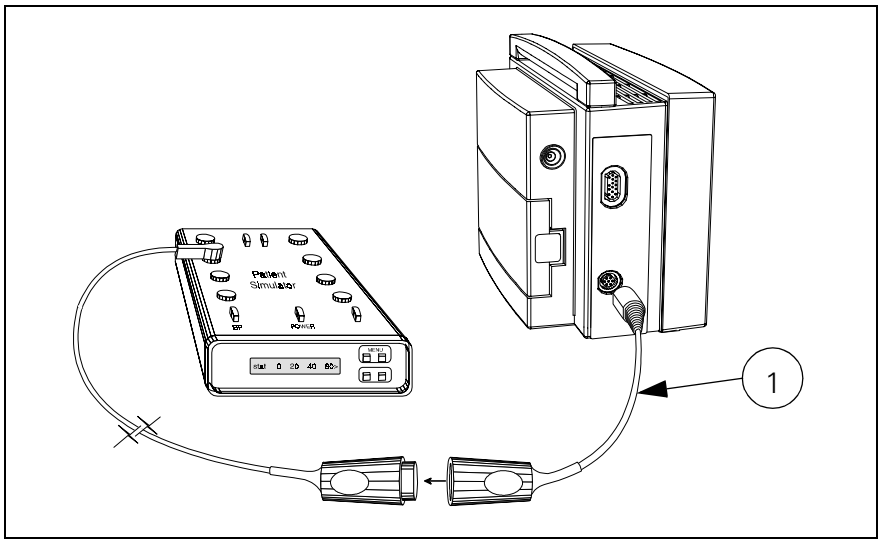

Figure 4-2 IBP Test Setup

1.11 Invasive Blood Pressure

IBP Test Setup

1. Connect simulator BP output to IBP input on monitor's left side panel, using adapter cable (① in Figure 4-2) Art. No. 33 68 383 E530U.
2. On *MAIN* Screen, select Channel 2 waveform field, and select following on Channel 2 menu:
   - Waveform - GP1
   - Size - 200 mmHg
3. Return to *MAIN* Screen.

Calibration

1. Apply a static pressure of 0 mmHg from patient simulator.
2. Select pressure parameter box.
3. Select "Zero" in IBP Setup window.
4. Verify that "GP1 Zero Accepted" exhibits in message field, and that a flat pressure curve is displayed at 0 line in second waveform channel.
5. Change static pressure to 100 mmHg at patient simulator.
6. Select Manometer Cal. in IBP Setup window.

7. Set Manometer Cal. to 100.

   Note: Even if Manometer Cal. reads 100, select field and reset value to 100.

8. Verify that "GP1 Cal. Accepted" exhibits in message field simultaneously with a tone.
9. Return to *MAIN* screen.
10. Verify that Mean, Diastolic and Systolic values displayed read 100 mmHg ±2 mmHg, and that a flat pressure curve is displayed exactly in the middle of waveform channel.
11. Increase static pressure to 200 mmHg
12. Verify that Mean, Diastolic and Systolic values displayed are 200 ±2 mmHg, and that flat pressure curve is displayed in waveform channel.

IBP Limits Alarms

1. In Alarm Limits Table select AutoSet.
2. In Alarm Limits Table set Syst/Dia/Med Alarm to ON.
3. Set simulator to stat < 50.
4. Verify that monitor responds with following Serious Alarm indications:
   - Mean, Diastolic and Systolic values = simulator stat setting.
   - GP1 parameter field changes to yellow.
   - Serious Alarm tone sounds.
   - Messages "GP1 Static", "GP1 Dia <170" and "GP1 Mean <170"blink on and off in message field.
5. In Alarm Limits Table set Sys/Dia/Med Alarm to OFF.

2 Leakage Current Test

The SC6002XL is a battery operated device, isolated from ground by the transformer in an ac power adapter, or grounded through the CPS or IDS power supply, when operated from an external ac power source. Leakage current tests assure that under both normal and fault conditions, any leakage current does not exceed values given in Table 4-2. Use the following general procedure to measure leakage currents.

Table 4-2 Leakage Current Tests

TEST	Max. Current
Combined Lead Leakage	<10µA
Individual Lead Leakage	<10µA
Paired Lead Leakage	<10µA
Leakage with Line Voltage on Leads	<50µA

1. Perform leakage current tests on a SC6002XL series monitor with ac power adapter (see Figure 4-3), CPS Communications/Power Supply (see Figure 4-4), or IDS power supply (see Figure 4-5) plugged into leakage tester.
2. Attach MutiMed cable (① in Figure 4-3, Figure 4-4, and Figure 4-5) to Monitor.
3. Attach MutiMed cable ECG leads (② in Figure 4-3, Figure 4-4, and Figure 4-5) to corresponding posts at Leakage Tester.

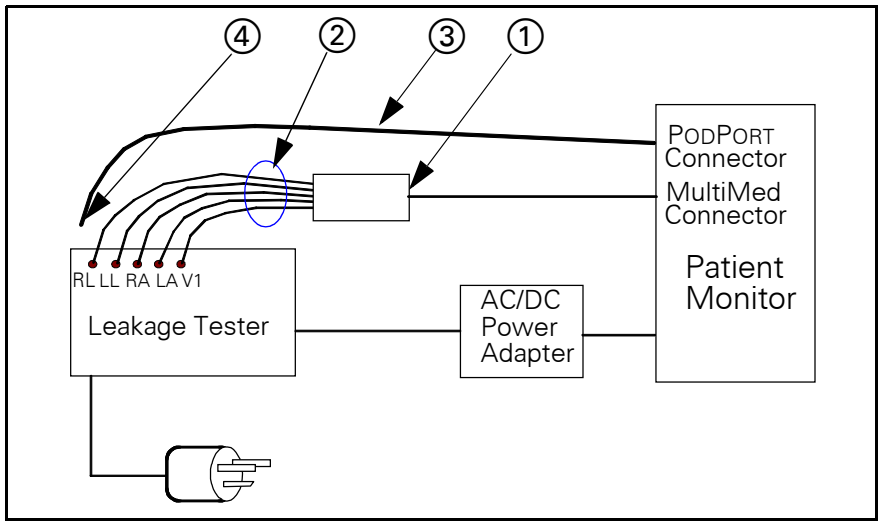

Figure 4-3 Block Diagram: Earth Leakage Current (AC/DC Power Adapter)

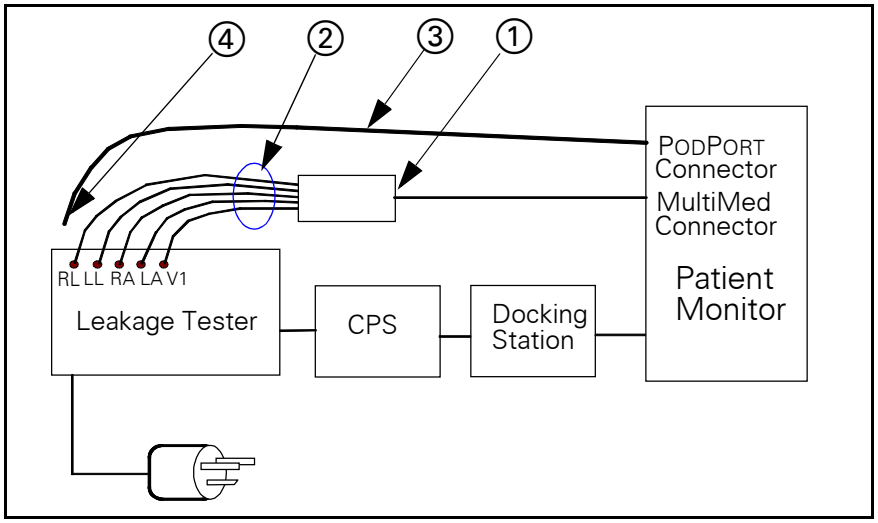

Figure 4-4 Block Diagram: Earth Leakage Current (CPS/Docking Station)

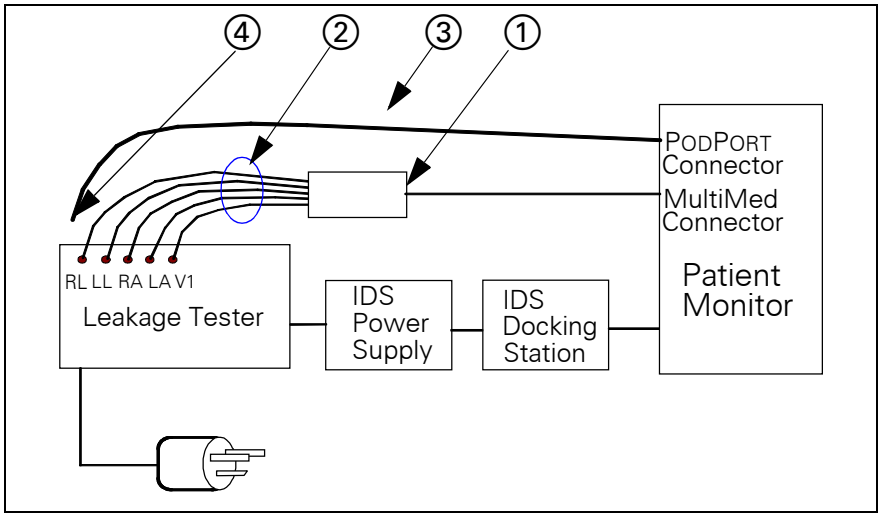

Figure 4-5 Block Diagram: Earth Leakage Current (INFINITY Docking Station)

4. Follow leakage tester manufacturer's instructions to measure each leakage current given in Table 4-2, for each of following conditions:
   - Combined Lead Leakage
   - Individual Lead Leakage
   - Paired Lead Leakage
   - Leakage with Line Voltage on Leads
5. Verify that current does not exceed values shown in Table 4-2.
6. Document test results on a copy of Functional Verification Checklist in Appendix D.
7. Disconnect MutiMed cable ECG leads (② in Figure 4-3, Figure 4-4, and Figure 4-5) from corresponding posts at Leakage Tester.
8. Short together all leads to shield at end of PodCom Leakage Test Cable (④ in Figure 4-3, Figure 4-4, and Figure 4-5) and connect leads and shield to RL post of Leakage Tester.
9. Attach Pod Com Leakage Test Cable (③ in Figure 4-3, Figure 4-4, and Figure 4-5) to SC 6002XL PODPORT connector.
10. Follow leakage tester manufacturer's instructions to measure each leakage current given in Table 4-2, for each of following conditions:
    - Individual Lead Leakage
    - Leakage with Line Voltage on Leads
11. Verify that current does not exceed values shown in Table 4-2.
12. Document test results on a copy of Functional Verification Checklist in Appendix D.

3 Calibrating NBP System

N.B. Regulations in some national jurisdictions may place specific requirements on who may perform this procedure.

3.1 Introduction

The NBP function requires external intervention for calibration of the internal transducer and characterization of the internal pneumatics. The calibration procedure consists of the following tasks:

Step 1) Testing for leaks in the pneumatic system

Step 2) Calibrating the transducer

Step 3) Characterizing pneumatic tolerances (if required)

Use tools listed in the table below as required, to check calibration, and when necessary, calibrate the non-invasive pressure transducer: Note pressure indicator required for NBP calibration.

Table 4-3 NBP Calibration Test Equipment

Test Equipment	Description
Either: a) PC or laptop computer equipped with terminal emulation software and serial port, or b) terminal equipped with a serial port	 e.g., Microsoft® Windows™ e.g., VT100 terminal-emulation software package (e.g., SmartTerm)
SHP ACC CBL DIAG UART	Art. No. 47 14 346 E530U
NBP Calibration Assembly	Art. No. 28 77 855 EE54U

Table 4-3 NBP Calibration Test Equipment (Continued)

Test Equipment	Description
NBP Hose	Art. No. 12 75 275 EH50U
Side Panel Removal Tool	Art. No. 47 24 667 E533U
Interface Plate	Art. No. 33 76 493 E530U
*Dynatech cuff link or *Baumonometer	
*For calibration check. For calibration, Paroscientific Pressure Meter, Model 740-12D, or equivalent, is recommended. An equivalent must be accurate to ±0.3 mmHg from 0 to 330 mmHg.	

Note: For NBP calibration, the Pressure Indicator must be accurate to ±0.3 mmHg from 0.0 mmHg to 330.0 mmHg, and must be calibrated. The calibration must be traceable to National Standards.

3.2 Calibration Procedure

Complete the following steps to calibrate the NBP system.

1. Power down monitor.
2. Disconnect monitor from docking station (if mounted).
3. Remove left side panel. Refer to Section 5.1.2 in Chapter 3: Subassembly Replacement Procedures.
4. Assure that system has been set up and checked for leakage as described in Section 1.10.1.
5. Connect AC power adapter (Art. No. 59 53 539 E530U or Art No. 51 88 607 E530U) and power up monitor.
6. After *MAIN* screen displays on monitor, double-click rotary knob to accept "New Patient".
7. Turn rotary knob until NBP field is highlighted, then depress knob.
8. Set following in NBP parameter field menu:
   - Interval Mode: OFF
   - Calibration Mode: ON (Observe "NBP Cuff 0 mmHg" appears in lower right area of NBP field)
   - Inflation Mode: Adult:270
9. Using hand bulb, increase pressure to 260±2 mmHg.
10. Adjust calibration potentiometer (① in Figure 4-6 on page 59) through access port in left side of monitor, until monitor (lower right area of NBP field) and pressure indicator readings match ± 1mmHg.

    Note: Siemens recommends using a small flathead jewelers screwdriver to make potentiometer adjustments.
11. Using deflation valve on hand bulb, reduce pressure in steps to 200, 150, 100, and 50 ±5 mmHg. Allow pressure to stabilize at each level, then verify that pressures displayed on monitor and pressure indicator are within ±1 mmHg of each other at each level.
12. Repeat steps 10 and 11 until all pressures steps displayed on monitor (200, 150, 100, and 50 ±5 mmHg) are within ±1 mmHg of each other at each level.
13. Set Calibration Mode to "OFF."
14. Power-down monitor.
15. Enter date of calibration on a copy of Functional Verification Checklist in Appendix D.

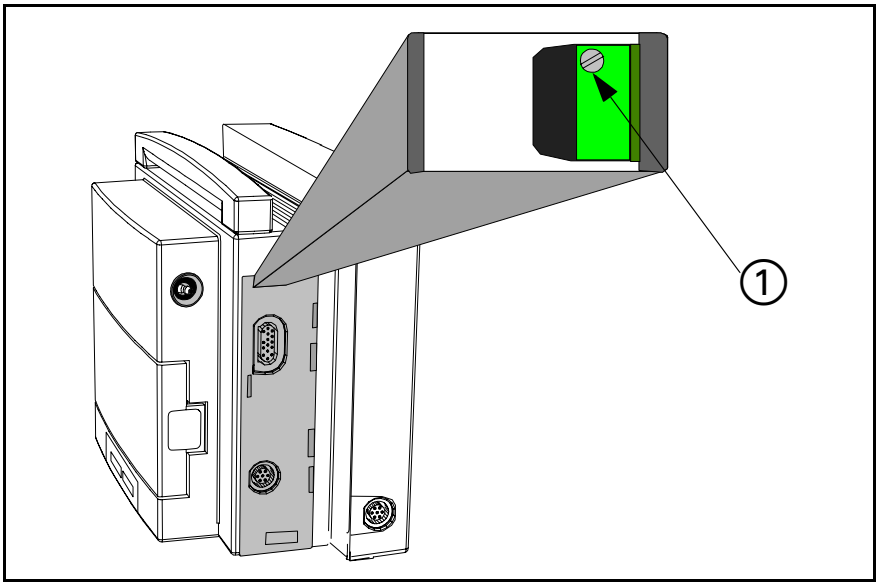

Figure 4-6 Calibration Potentiometer

3.3 Characterization

Pneumatics in the monitor have tolerances that affect flow control of pump and valves during NBP measurements. To accurately represent flow data to NBP software, tolerances must be determined and characterized, to allow software to compensate for variations. Tolerances are represented as "pneumatic characterization constants" stored in EEPROM, each of which is unique to its set of pneumatics. Characterization is required after NBP subassembly or Main Processor Subassembly have been replaced, or if there is a suspected problem such as difficulty in calibrating NBP. The process for determining and storing constants is programmed into the monitor's software.

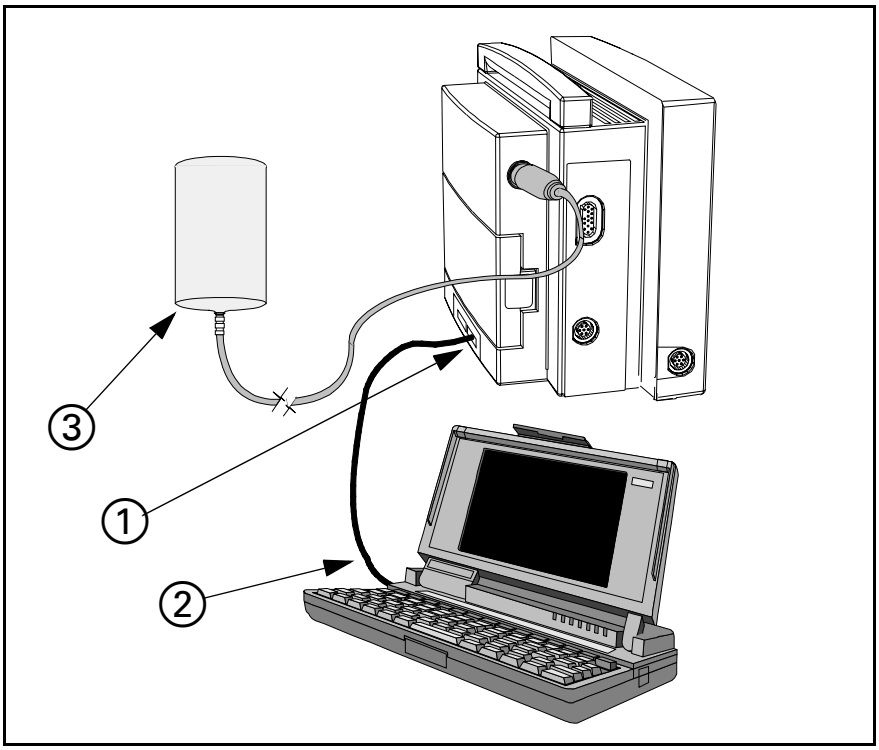

Figure 4-7 NBP Characterization Setup

3.3.1 Characterization Setup

1. Install Interface Plate (① in Figure 4-7), Art. No. 33 76 493 E530U, on monitor.
2. Connect diagnostic cable, CBL DIAG UART 47 14 346 E530U (② in Figure 4-7), between serial port on PC/laptop and X7 on interface plate. If PC/laptop is equipped with Windows 3.1, go to Section 3.3.2. If PC/laptop is equipped with Windows 95, go to Section 3.3.3.

3.3.2 Windows 3.1

1. On PC/laptop computer, double-Click on Accessories window.
2. Double-click on Terminal Icon.
3. Select Settings, and then Communications.
4. Set following parameters as given, and click on OK.
   - Connector: Com **X** (**X** = PC/laptop serial port to which diagnostic cable was attached in Section 3.3.1)
   - Baud: 19200
   - Data bits: 8
   - Stop bit: 1
   - Parity: none
   - Flow Control: none
   - Parity Check: leave blank
   - Carrier detect: leave blank
5. Press <Enter> and proceed to section 3.3.4.

3.3.3 Windows 95

1. Select "Start" and scroll to "Programs", then "Accessories", then "Hyperterminal".
2. At "Hyperterminal" window, select "Hypertrm.exe" icon.
3. If asked to set up for modem use, select NO.
4. At "Connection Description" window, enter **SC6002XL** in "Name" box, select any icon, and select OK.
5. At "Phone Number" window, "Connect using:" box pull-down menu, select **Direct to Com X** (**X =** serial port on PC/laptop to which diagnostic cable was attached in Section 3.3.1) and click on OK.
6. At "Com X Properties" window, set following parameters and click OK.
   - Bits per second: 19200
   - Data bits: 8
   - Parity: none
   - Stop bit: 1
   - Flow Control: none
7. Press <Enter> and proceed to 3.3.4.

3.3.4 Complete Characterization

1. Plug in monitor power adapter and power-up monitor.
2. After *MAIN* screen displays on monitor, press <Esc> on PC/laptop keyboard.

SC6002XL SUPPORT MENU

00) Error Display	01)Event Log
02) Database Defaults	03)Real-time Clock
04) Set EEPROM H/W Rev.	05)Set NBP Constants
06) Verify NBP Constants	07)Display Service Data

Press ENTER to exit

Figure 4-8 Support Menu (Item numbers may differ between versions of installed software.)

3. When "Enter Password" prompt displays, type in **7412** and press <Enter> to bring up SC6002XL SUPPORT MENU (See Figure 4-8).
4. Type in **5** and press <Enter> to access NBP Characterization function.

   Note: The item number to access the NBP function may be different for different versions of installed software.
5. Connect half-liter standard volume to monitor (③ in Figure 4-7) and follow instructions on terminal display.
6. After Characterization is complete (≈ 30 seconds), verify "Pneumatic Characterization was SUCCESSFUL!" is displayed at PC/laptop.

   Note: If the test fails because of a constant out-of-range condition, examine NBP pneumatics and replace if out-of-range condition persists.
7. Power down monitor.
8. Document test results on a copy of Functional Verification Checklist in Appendix D: Functional Verification Checklist.

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Chapter 5: Troubleshooting

1 Troubleshooting

If the Monitor should fail to respond properly to procedures prescribed in the User Guide for the installed software version, use the procedures below to aid in identifying and remedying the problem.

1.1 Power Problems

1.1.1 No Response When POWER ON/OFF Key Pressed

There are several possible reasons why a Monitor might not respond when the Power ON/OFF key is pressed. Required troubleshooting procedures depend on power sources connected to the monitor. Refer to Table 5-1.

Table 5-1 Power-On Problems

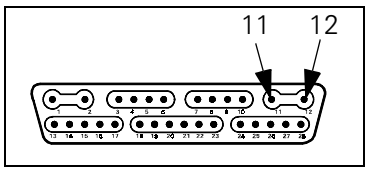
Conditions	Possible Cause(s)	Troubleshooting and Remedial Action
Monitor connected directly to Power Adapter; Battery Charger LED not illuminated* * AC/DC Power Adapter, Art. No. 51 88 607 E530U does not have an LED.	Power Adapter malfunction Monitor Malfunction	1. Assure Power Adapter is connected to an active hospital power source. 2. Disconnect power adapter from Monitor and measure Power Adapter output voltage. • If voltage = 11.6 to 13.8 VDC, continue to step 3. • If voltage < 11.6 VDC or > 13.8 VDC, replace Power Adapter. 3. Replace Front Bezel. 4. If problem persists, replace Front Panel PC Board. 5. If problem persists, replace Main Processor Subassembly. 6. If problem persists, contact TSS in Solna or Danvers.
Monitor on docking station; Battery charger LED not illuminated 	IDS Power Supply malfunction CPS/IDS malfunction Monitor malfunction	1. • If IDS, assure that IDS power supply is connected to an active hospital power source. • If CPS, assure that CPS is connected to active hospital power source and switched ON. NOTE:If CPS or IDS power supply LED is not illuminated, check power source and power cable. If O.K., replace CPS or IDS power supply. 2. Measure voltage between pins 11 and 12 at docking connector on docking station. (See left.) • If voltage = 11.6 to 13.8 VDC, continue to step 3. • If voltage < 11.6 VDC or > 13.8 VDC, replace IDS Power Supply or CPS. 3. Replace Front Bezel. 4. If problem persists, replace Front Panel PC Board. 5. If problem persists, replace Main Processor Subassembly. 6. If problem persists, contact TSS in Solna or Danvers.

Table 5-1 Power-On Problems (Continued)

Conditions	Possible Cause(s)	Troubleshooting and Remedial Action
Monitor on docking station or directly connected to Power Adapter; Battery charger LED illuminated	Corrupted Software Front Bezel malfunction Front Panel PCB malfunction Main Processor malfunction	1. Press Power On key to power monitor ON. 2. Try booting with monitor software PCMCIA card inserted into card slot. 3. If problem persists, replace Front Bezel. 4. If problem persists, replace Front Panel PC Board. 5. If problem persists, replace Main Processor Subassembly. 6. If problem persists, contact TSS in Solna or Danvers.
NO power. Monitor not connected to AC Power Adapter or docking station; battery installed	Battery discharged or needs to be replaced Battery charger circuitry malfunction	1. Connect monitor to AC Power Adapter or Docking Station. 2. When Battery charger LED illuminates, press POWER ON/OFF key to power monitor ON and access *MAIN* screen. NOTE: If Battery charger LED fails to illuminate, refer to section above on Condition - "Monitor connected directly to Power Adapter; Battery Charger LED not illuminated or "Monitor on docking station; Battery charger LED not illuminated" 3. Allow monitor or remain on Power Adapter or powered Docking Station for ≈ 1 hr. Disconnect monitor from Power Adapter or powered Docking Station. After ≈ 30 sec. check battery level bar graph, located at bottom left side of display, and verify that a portion of the bar graph is green. • If a portion of the bar graph is green, reconnect monitor to Power Adapter or powered Docking Station. Leave monitor connected an additional 4.5 hrs for Lead-acid type battery or 7 hrs for an optional Lithium-ion type battery, then go to step 4. • If no portion of the bar graph is green, replace main battery, and then repeat step 3. If charge level remains constant, go to step 5. 4. After charging the Main battery (≥4.5 hrs for Lead-acid type battery or ≥7 hrs for optional Lithium-ion type battery) recheck battery charge level. • If charge level = 100%, return monitor to clinical service. • If charge level <100% replace Main battery. 5. If problem persists with new main battery, replace Main Processor Subassembly. 6. If problem persists, contact TSS in Solna or Danvers.

1.1.2 Power On/Off Piezo Tone Fails to Sound.

Table 5-2 Power-off Alarm Malfunction

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
Piezo tone fails to sound when monitor powered on, if monitor loses power, or when monitor powered-off.	Front Panel PCB malfunction Main Processor malfunction	1. Replace Front Panel PC Board 2. If problem persists, replace Main Processor Subassembly. 3. If problem persists, contact TSS in Solna or Danvers.

1.1.3 Power-Up Sequence Fails to Complete Properly

Table 5-3 Power-up Process Malfunction

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
Power inputs all OK but monitor fails to complete power-up sequence	Software program corrupted Main PCB malfunction	If power ON LED illuminates but monitor fails to complete power-up sequence, reinstall software as follows: 1. With monitor powered off, insert PCMICA card into slot at right side of monitor. 2. Power monitor on. 3. If monitor fails to properly complete power-up sequence, replace Main Processor Subassembly, 4. If problem persists, contact TSS in Solna or Danvers.

1.2 Optical Encoder Malfunction.

Table 5-4 Rotary Knob Malfunction

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
Rotary knob fails to properly select fields, or pressing the knob in fails to activate a menu or select a default.	Front Panel PC Board malfunction Optical Encoder malfunction Main Processor malfunction	1. Replace Front Panel PC Board. 2. If problem persists, replace optical encoder. 3. If problem persists, replace Main Processor Subassembly. 4. If problem persists, contact TSS in Solna or Danvers.

1.3 TFT-LCD Display Malfunction.Fixed

Table 5-5 LCD Display Malfunction

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
> 17 inoperative pixels (“stuck” ON or OFF).	LCD screen malfunction	Replace TFT-LCD Display.

Table 5-5 LCD Display Malfunction (Continued)

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
Areas of display missing or color contaminated	Front Panel PC Board malfunction Processor on Main PCB malfunction	1. Replace Front Panel PC Board. 2. If problem persists, replace Main Processor Subassembly. 3. If problem persists, contact TSS in Solna or Danvers.
Backlight fails to provide sufficient and consistent background illumination for the LCD display.	TFT-LCD Display malfunction Inverter malfunction Front Panel PC Board malfunction Main Processor malfunction	1. Replace TFT-LCD Display Backlights. 2. If problem persists, replace Inverter PC Board. 3. If problem persists, replace Front Panel PC Board. 4. If problem persists, replace Main Processor Subassembly. 5. If problem persists, contact TSS in Solna or Danvers.

1.4 Fixed Key Fails to Function.

Table 5-6 Fixed Key Malfunction

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
A Fixed Key fails to initiate change	Front Bezel malfunction Front Panel PC Board malfunction Main Processor malfunction	1. Replace Front Bezel Subassembly. 2. If problem persists, replace Front Panel PC Board. 3. If problem persists, replace Main Processor Subassembly. 4. If problem persists, contact TSS in Solna or Danvers.

1.5 Visual or Audible Alarm Reporting Failure.

Table 5-7 Alarm Malfunctions

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
Audible Alarm O.K., but Visual Alarm Fails.	Software problem	1. Try reinstalling software. 2. If problem persists, contact TSS in Solna or Danvers.
Visual Alarm O.K., but Audible Alarm Fails.	Speaker malfunction Front Panel PC Board malfunction Main Processor malfunction	1. Power-cycle monitor and listen for tone after icon appears on power-up screen (not the piezo, which sounds before the icon appears). 2. If tone fails to sound, replace speaker. 3. If problem persists, replace Front Panel PC Board. 4. If problem persists, replace Main Processor Subassembly. 5. If problem persists, contact TSS in Solna or Danvers.

1.6 NBP Malfunction

Table 5-8 NBP Malfunctions

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
NBP fails to zero properly, fails characterization, or fails calibration check	NBP pneumatic system malfunction Main Processor malfunction	1. If monitor fails calibration, perform characterization procedure (see Section 3.3 in Chapter 4: Functional Verification and Calibration). 2. If monitor fails characterization or problem persists,replace Main Processor Subassembly. 3. If problem persists, contact TSS in Solna or Danvers.
NBP pump fails to start/stop when NBP key on front panel is pressed	Front Bezel malfunction Front Panel PC Board malfunction NBP pump subassembly malfunction Main Processor malfunction	1. If monitor reporting NBP in fault mode, or error message displays, power-cycle monitor. 2. Otherwise, replace front bezel Subassembly. 3. If problem persists, replace Front Panel PC Board. 4. If problem persists, replace NBP Pump Subassembly. 5. If problem persists, replace Main Processor Subassembly. 6. If problem persists, contact TSS in Solna or Danvers.
NBP pump starts, but cuff fails to inflate/deflate properly	Cuff assembly malfunction NBP pneumatic system malfunction	1. Recheck cuff assembly and installation, and replace cuff assembly if defective. 2. If problem persists, check NBP tubing in rear housing of monitor. 3. If tubing OK, replace NBP Pump Subassembly. 4. If problem persists, contact TSS in Solna or Danvers.

1.7 $etCO_2$ Malfunction.

Table 5-9 $etCO_2$ Malfunctions

Symptom(s)	Possible Cause(s)	Troubleshooting and Remedial Action
Parameter box fails to appear when sensor plugged into pod Sensor fails calibration	Sensor or cable malfunction $etCO_2$ Pod malfunction PodPort PC Board malfunction Main Processor malfunction	1. Replace $etCO_2$ Sensor. 2. If problem persists, replace $etCO_2$ Pod. 3. If problem persists, replace PodPort PC Board. 4. If problem persists, replace Main Processor Subassembly. 5. If problem persists, contact TSS in Solna or Danvers.
Persistent Adapter Failure message	Airway adapter or sensor window occluded Airway adapter malfunction Sensor malfunction	1. If adapter or sensor window occluded, clean window. 2. If problem persists, replace airway adapter. 3. If problem persists, replace sensor. 4. If problem persists, replace $etCO_2$ Pod. 5. If problem persists, contact TSS in Solna or Danvers.

1.8 No Printout from Recorder.

Table 5-10 Recorder Problems

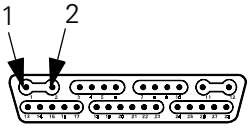
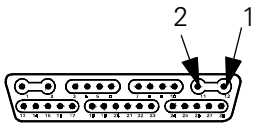
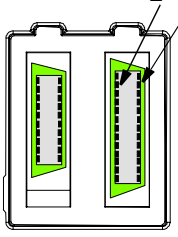
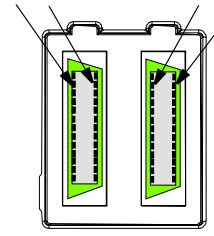
Symptoms	Possible Cause(s)	Troubleshooting and Remedial Action
Recorder Power LED NOT illuminated when Record key depressed	Recorder malfunction Cabling malfunction Interface Plate (if installed) malfunction CPS / IDS (if installed) malfunction Main Processor malfunction	1. Assure that all units in the power chain are properly connected and powered ON. 2. If problem persists do either a or b. Refer to illustrations below left. a If Recorder has installed Interface Plate, detach Interface Plate from Recorder, depress Record key at monitor and check voltage between pins 1 and 2 on Interface Plate docking connector. b If Recorder mounted on Auxiliary Docking Station, depress Record key and check voltage between pins 1 and 2 on Auxiliary Docking Station connector. 3. If voltage O.K., replace Recorder. 4. If voltage NOT O.K., check for +12VDC between pins 1 and 2 on monitor docking connector. • If voltage O.K., check for +12VDC between pins 1 and 2 of all docking connectors in path between monitor and recorder, and between pins 2 and 15 of X13 on CPS or IDS. Replace component that fails to provide 12VDC at the appropriate pins. • If voltage not O.K. on monitor docking connector, continue. 5. If problem persists, replace Recorder. 6. If problem persists, replace Main Processor Subassembly 7. If problem persists, contact TSS in Solna or Danvers.
Interface Plate, Auxiliary Docking Station - Docking Connector 1 2  Monitor Docking Connector 2 1 		
CPS 2 15  X12 X13 Recorder CPS 2 15 2 15  X13 X13		
Local Recorder connected directly to Monitor in standalone configuration	Recorder malfunction Interconnecting cable or connection malfunction Recorder or Monitor Interface Plate malfunction Main Processor PCB malfunction	1. With an ECG waveform from patient simulator on Monitor display, press Record key. • If "Recording Started" followed by double-tone, then "Recording Stored" message appears in the message field, continue to step 2. • If no message or recording appears, go to step 5. 2. If problem persists, and Recorder Cable Art. No. 43 18 130 E530U is installed, replace Recorder cable. 3. If problem persists, and separate Interface Plates and Recorder cable are installed, replace each item one at a time to isolate possible malfunction. 4. If problem persists, replace Recorder. 5. If problem persists, replace Main Processor Subassembly 6. If problem persists, contact TSS in Solna or Danvers.

Table 5-10 Recorder Problems (Continued)

Symptoms	Possible Cause(s)	Troubleshooting and Remedial Action
Local Recorder connected to Monitor through CPS or IDS	Recorder malfunction CPS/IDS - Recorder cable malfunction Recorder Interface Plate malfunction CPS or IDS malfunction Docking Station or CPS Bridge Plate malfunction Main Processor malfunction	1. With an ECG waveform from patient simulator on Monitor display, press Record key. • If "Recording Started" followed by double-tone, then "Recording Stored" message appears in the message field, check cables and connections between Monitor, CPS/IDS, and Recorder, then continue to step 2. • If no message or recording appears, go to step 3. 2. Substitute Recorder connection by installing Recorder cable, Art. No. 47 21 770 E530U or 43 13 560 E530U, in place of Docking Station, CPS/IDS, and cabling. • If problem persists, replace Recorder. • If problem disappears, replace each component bypassed by Recorder cable, Art. No. 47 21 770 E530U or 43 13 560 E530U, to isolate source of problem and replace malfunctioning component. 3. If problem persists, replace Main Processor Subassembly 4. If problem persists, contact TSS in Solna or Danvers.

1.9 Isolating Cable Malfunctions

A general troubleshooting and repair approach for cable malfunctions is to use a known input signal for any given parameter, and then replace a cable or sensor found to be malfunctioning. Cable malfunctions, including those associated with connectors on the cables, fall into one of three categories -- Open circuits, Short circuits, and Intermittent conditions

Open circuits and short circuits manifest themselves as a loss of signal. Software in the Monitor senses the loss, and generates an error message such as "ECG Leads Off" and "SpO2 Transparent." Typically, short circuits result in software resets.

An intermittent condition (e.g. ECG lead not making good skin contact) may manifest itself as noise displayed at the monitor screen. A source of ECG noise can often be isolated by removing the signal and shorting all ECG leads together. Then flex along the cable, particularly at connectors, while watching for noise indications on the monitor display.

1.10 Patient-Related Data Not Retained or Monitor Fails to Compute Trends

1) Replace Main PCB Subassembly.

2) If problem persists, contact TSS in Solna or in Danvers.

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Appendix A: Replaceable Parts

Refer to the Table and Figures on page 72 and page 73.

Table A-1 SC 6000XL - Replaceable Parts and Subassemblies

Item No.	Description	Siemens Article Number
1	E/M SPR LNGLBL 6002XL	
	E/M SPR LNGLBL 6002XL ENG	57 43 799 E551U
	E/M SPR LNGLBL 6002XL DEU	57 43 807 E551U
	E/M SPR LNGLBL 6002XL FRN	59 53 661 E551U
	E/M SPR LNGLBL 6002XL SPN	59 53 711 E551U
	E/M SPR LNGLBL 6002XL ITA	59 53 703 E551U
	E/M SPR LNGLBL 6002XL POR	59 53 729 E551U
	E/M SPR LNGLBL 6002XL NOR	59 53 695 E551U
	E/M SPR LNGLBL 6002XL SVE	59 53 687 E551U
	E/M SPR LNGLBL 6002XL NLD	59 57 399 E551U
	E/M SPR LNGLBL 6002XL DEN	59 53 679 E551U
2	E/M SPR BEZEL/LENS SC6002XL	59 53 968 E551U
3	E/M SPR OPTIC ENCODR SC SERIES	43 11 622 E533U
4	E/M SPR ROTARY KNOB SC 600X SERIES	43 16 662 E533U
5	E/M SPR FOOT .40 SQ X .25 THK (PKG-12)	43 11 374 E533U
6	E/M SPR DISLCD 6.5" TFT 256K	59 50 790 E551U
7	E/M SPR BACKLIGHT 6.5" TFT LCD (PKG'2)	72 58 945 E551U
8	PCB SPR A124 FT PNL SC6002XL NEC	59 57 258 E551U
9	E/M SPR DCAINV NEC + 5V 2 TUBE	59 50 808 E551U
10	E/M SPR PCB A140 POD COM INT	57 41 959 E547U
11	E/M SPR INTERMEDIATE SC6002XL	57 42 304 E551U
12	E/M SPR SPEAKER SC6002XL	59 47 218 E551U
13	E/M SPR A100 SHDL/HS SC6002XL(PROCESSOR (shipped w/SW installed and w/SW version label)	57 42 296 E551U
14	E/M SPR MANIFOLD NP SC 6002XL	59 50 782 E551U
15	E/M SPR FILTER MFLD NBP (PKG-10)	28 66 726 E516U
16	E/M SPR RT RET PLATE 6002XL COND (incl. LBL)	72 61 907 E551U
17	E/M SPR LFT RET PLT SC6002XL (incl. LNG LBL)	72 58 168 E551U
18	E/M SPR RAM CARD EJECTOR BUTTN (PKG-10)	33 76 865 E522U
19	E/M SPR HANDLE SC6000/6000P	47 16 424 E533U
20	E/M SPR CBL HNS BATT SC6002XL	59 54 974 E551U
21	E/M SPR LATCH BATTERY RETAINER	33 79 943 E533U
22	SHP ACC BATTERY (Lead-acid)	59 47 697 E533U
	SHP ACC BATTERY (Lithium-ion)	57 32 354 E533U
23	E/M SPR CVR BATTERY SC6000/6000P	33 77 491 E 533U
24	E/M SPR HOUSING REAR SC6002XL (Monitor serial number required to order replacement housing	59 54 784 E551U
25	E/M SPR PLATE RETAINER SC600X	33 77 533 E533U
26	E/M SPR FUNNEL SC6002XL	57 41 033 E551U
27	E/M SPR NBP CAL PORT CVR	43 28 816 E533U

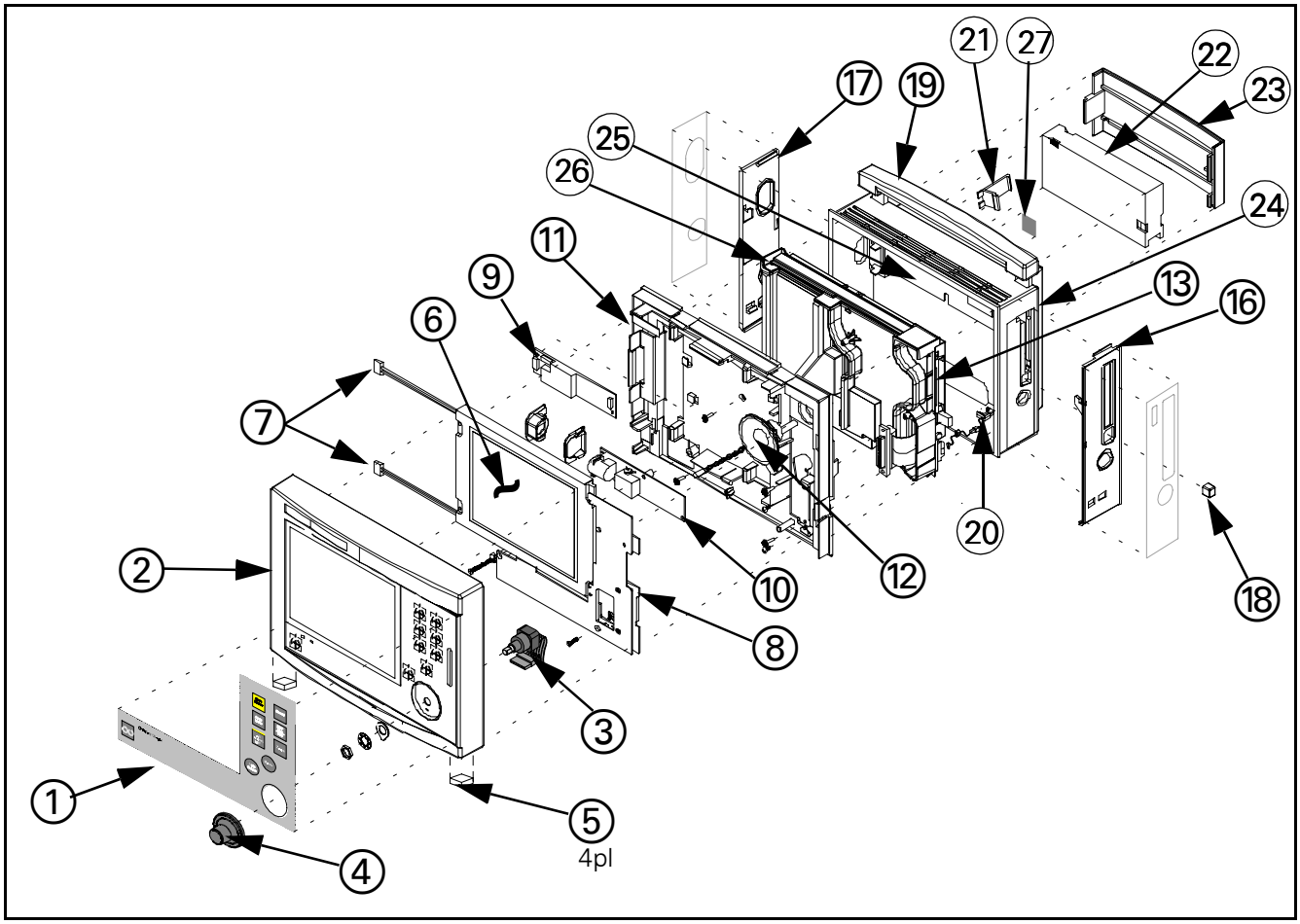

Figure A-1 SC 6002XL Exploded View

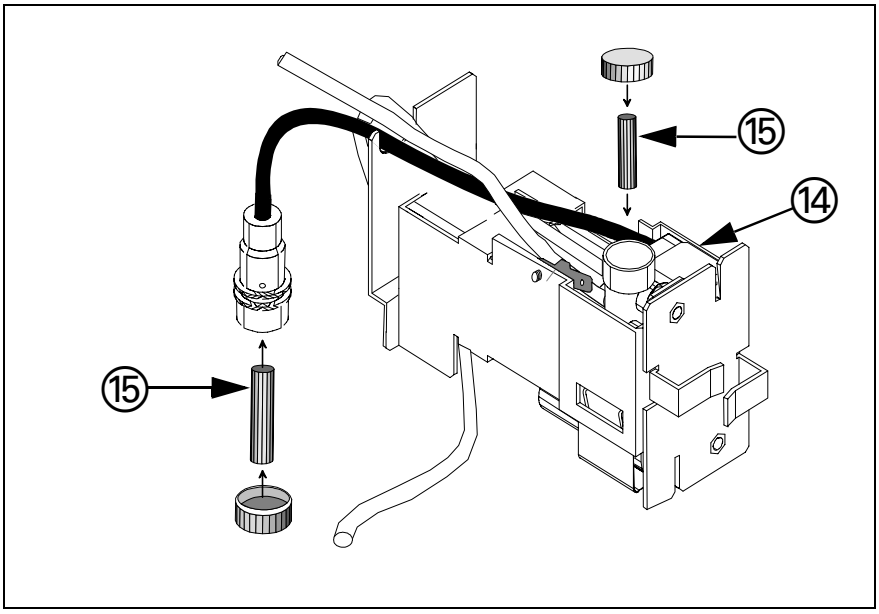

Figure A-2 NBP Subassembly (shown with filters exposed)

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Appendix B: Connector Pinouts

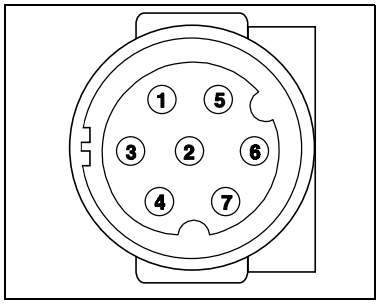

Figure B-1 IBP Connector (see Table B-1)

Table B-1IBP Connector Pinouts

Pin No.	Signal
1	+VREF
2	–VREF
5	+IBP
6	–IBP
3, 4, 7	GND
8, 9	SHIELD

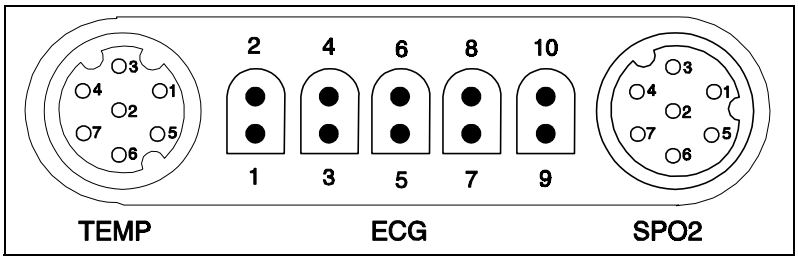

Figure B-2MultiMed Pod Connector (see Table B-2)

Table B-2 MultiMed Pod Connector Pinouts

Temp		SPO2		ECG			
Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin.No.	Signal
1	TA	1	DETA	1	SHGND	2	LA
2	TB*	2	DETK SH	3	SHGND	4	LL
3	TCOM	3	NC	5	SHGND	6	RA
4	NC	4	REDK	7	SHGND	8	V
5	NC	5	RCALRTN	9	SHGND	10	RL
6	NC	6	RCALIB				
7	NC	7	IRK				
*Not Used in SC6000 Series							

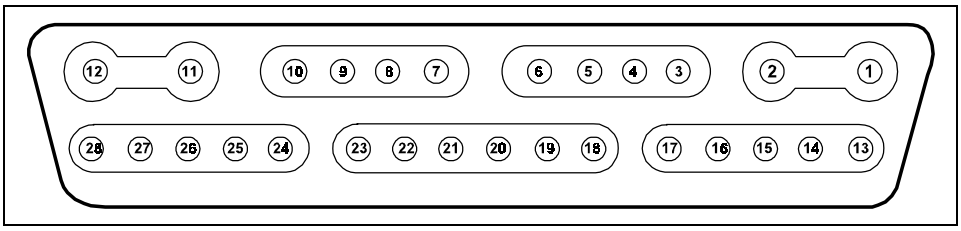

Figure B-3Docking Station Connector (see Table B-3)

Table B-3 Docking Station Connector Pinouts

Pin No.	Signal	Pin No.	Signal
1	RCDRPWR	15	DUTX2
2	DCGND	16	DURX2
3	PTXD3	17	DCGND
4	PRXD3	18	VGARED
5	DCGND	19	VGAGRN
6	EXTAUD	20	VGABLU
7	ALARM	21	DCGND
8	PSNL	22	VSYNCLB
9	DUTX1	23	HSYNCLB
10	DURX1	24	RCV–
11	DCGND	25	RCV+
12	DSPWR	26	TX–
13	DURTS	227	TX+
14	DUCTS2	28	SW6

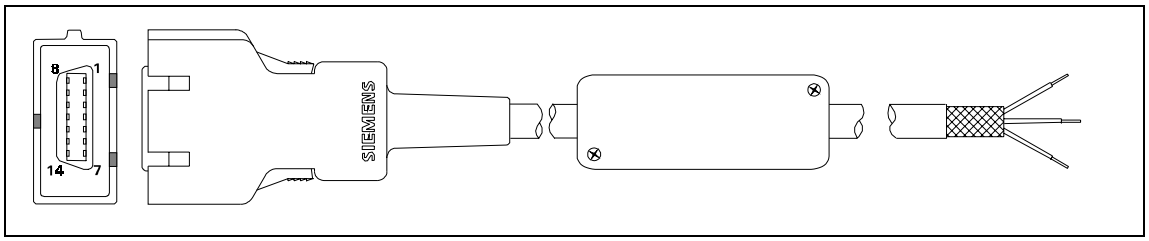

Figure B-4 SHP ACC CBL ALARM UNTERM 5M (see Table B-4)

Table B-4 Remote Alarm Cable Color Code

Color Code			
Connector Pin No.	Relay Input Wire Color	SPDT Relay Output	Circuit Status
1	Tan	Brown	RTN
2 - 8	NC	Green	Inactive Open
9	Orange	White	Inactive Closed
10 - 14	NC		

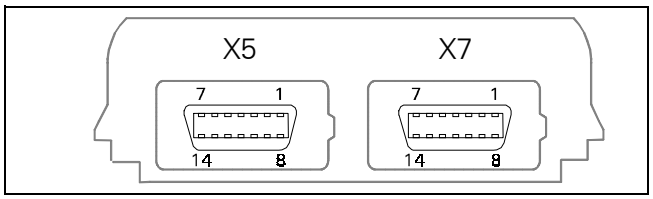

Figure B-5 Interface Plate Connector (see Table B-5)

Table B-5 Interface Plate Connectors Pinouts

Pin No	CRT - X5	Recorder/Alarm - X7
1	Ext Red	GND
2	VGND	+12VDC
3	Ext Grn	Rec Tx
4	VGND	+12VDC
5	Ext Blu	Diag Tx
6	VGND	+12VDC
7	GND	Rec RTS
8	H Sync	Rec CTS
9	V Sync	Alarm Out
10	Rem TxD	Rec GND
11	Rem RxD	Rec GND
12	Power Switch	Rec Rx
13	Rem Audio	Rec GND
14	Rem Audio Ret	Diag Rx

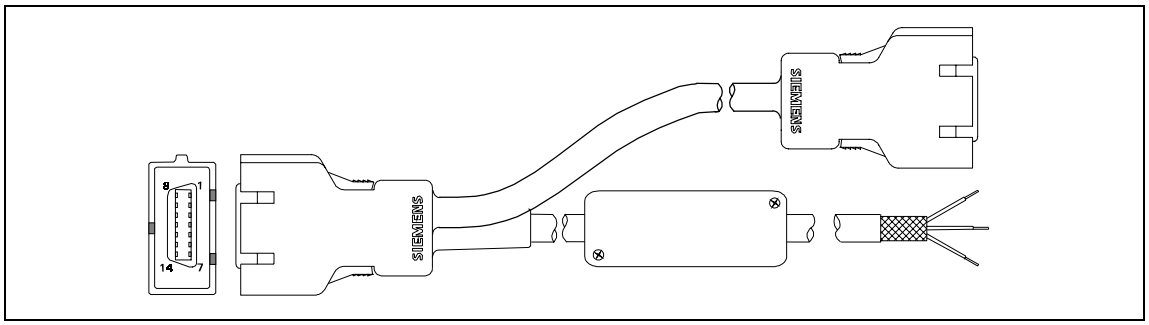

Figure B-6SHP ACC CBL Y RECORDER/ALARM (see Table B-6)

Table B-6 Remote Alarm Cable Color Code

Color Code			
Connector Pin No.	Relay Input Wire Color	SPDT Relay Output	Circuit Status
1	Tan	Brown	RTN
2 - 8	NC	Green	Inactive Open
9	Orange	White	Inactive Closed
10 - 14	NC		

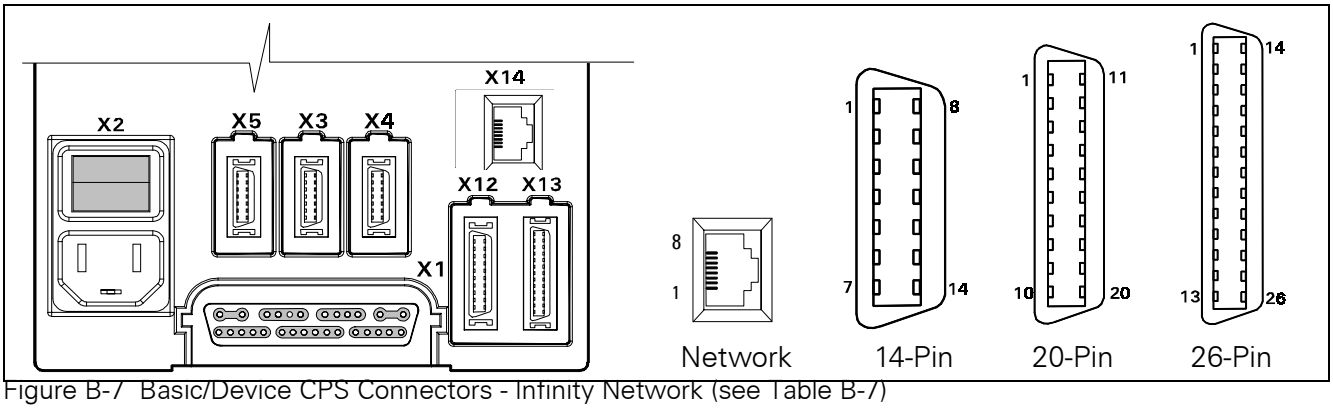

Figure B-7 Basic/Device CPS Connectors - Infinity Network (see Table B-7)

Table B-7 INFINITYNET CPS Connector Pins

ALM/KB/DIAG/COMM-1 (X4)		ALM/KB/DIAG/COMM-2 (X3)		External CRT (X5)		AUX/MIB/CANBUS(X12)		Recorder (X13)	
Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin.No.	Signal	Pin.No.	Signal
1	GND	1	GND	1	Ext Red	1	MIB1 D+	1	R50A TxD
2	Tx Data KB	2	Tx Data KB	2	VGND	2	MIB1 Pwr	2	AUX Pwr2
3	Rem Kbd Pwr	3	Rem Kbd Pwr	3	Ext Grn	3	MIB1 D-	3	R50A RxD
4	ISD Power	4	ISD PWR	4	VGND	4	MIB2 Pwr	4	AUX Pwr2
5	Diag TxD (CPS)	5	Diag TxD	5	Ext Blu	5	MIB1 S+	5	R50A CTS
6	DEBUG1	6	MCBOOTL	6	VGND	6	CAN+	6	AUX Pwr2
7	ISD GND	7	ISD GND	7	GND	7	MIB1 S-	7	R50A RTS
8	RxData KB	8	RxData KB	8	H-Sync	8	CAN R_L	8	AUX Pwr2
9	Alarm Out	9	Alarm Out	9	V-Sync	9	AUX1 ID0	9	
10	GND	10	GND	10	Remote TxD	10	AUX1 ID1	10	AUX Pwr2
11	HWBootL	11	NMI	11	Remote RxD	11	AUX1 ID2	11	AUX2 ID0
12	COMM-1 Rx	12	COMM-2 Rx	12	Power Switch	12	MIB2 D+	12	AUX ID1
13	COMM-1 Tx	13	COMM-2 Tx	13	Rem Audio	13	GND	13	AUX ID2
14	Diag RxD	14	Diag RxD	14	Rem Audio Ret	14	MIB2 D-	14	AUX P Enb
						15	GND	15	P GND
						16	MIB2 S+	16	AUX Tx+
						17	GND	17	P GND
						18	MIB2 S-	18	AUX Tx-
						19	CANBUS+	19	P GND
						20	Chassis GND	20	AUX Rx+
								21	P GND
								22	AUX Rx-
								23	P GND
								24	
								25	GND
								26	GND

Network (X14)	
Pin No.	Signal
1	Tx+
2	Tx-
3	Rx+
6	Rx-

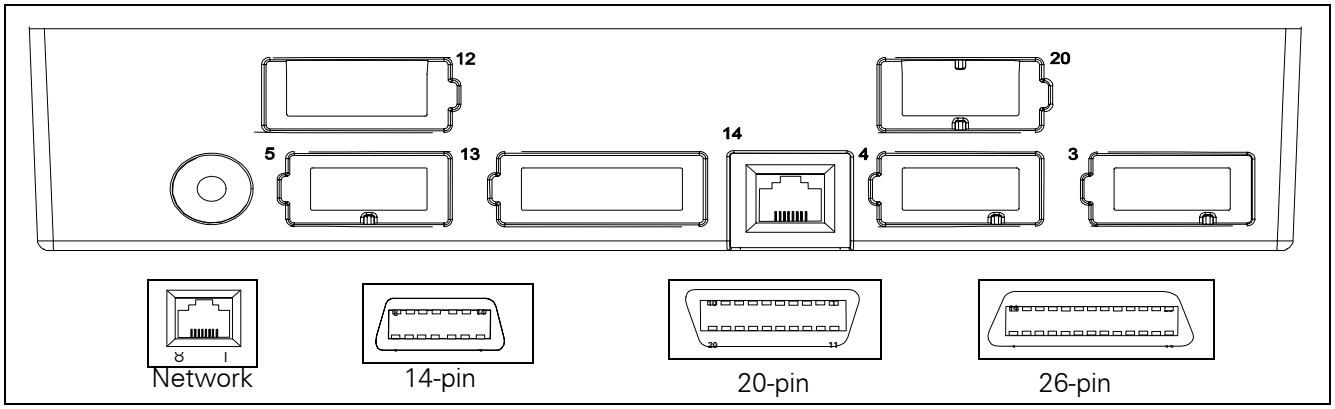

Figure B-8 Infinity Docking Station Connectors(Refer to Table B-8.)

Table B-8 Infinity Docking Station Connectors

ALM/KB/DIAG/COMM-1 (X4)		ALM/KB/DIAG/COMM-2 (X3)		External CRT (X5)		AUX/MIB/CANBUS(X12)		Recorder (X13)	
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GND	1	GND	1	Ext Red	1	MIB1 D+	1	R50A TxD
2	Tx Data KB	2	Tx Data KB	2	VGND	2	MIB1 Pwr	2	AUX Pwr2
3	Rem Kbd Pwr	3	Rem Kbd Pwr	3	Ext Grn	3	MIB1 D-	3	R50A RxD
4	ISD Power	4	ISD PWR	4	VGND	4	MIB2 Pwr	4	AUX Pwr2
5	Diag TxD (CPS)	5	Diag TxD	5	Ext Blu	5	MIB1 S+	5	R50A CTS
6	DEBUG1	6	MCBOOTL	6	VGND	6	CAN+	6	AUX Pwr2
7	ISD GND	7	ISD GND	7	GND	7	MIB1 S-	7	R50A RTS
8	RxData KB	8	RxData KB	8	H-Sync	8	CAN R_L	8	AUX Pwr2
9	Alarm Out	9	Alarm Out	9	V-Sync	9	AUX1 ID0	9	
10	GND	10	GND	10	Remote TxD	10	AUX1 ID1	10	AUX Pwr2
11	HWBootL	11	NMI	11	Remote RxD	11	AUX1 ID2	11	AUX2 ID0
12	COMM-1 Rx	12	COMM-2 Rx	12	Pwr Switch	12	MIB2 D+	12	AUX2 ID1
13	COMM-1 Tx	13	COMM-2 Tx	13	Rem Audio	13	GND	13	AUX2 ID2
14	Diag RxD	14	Diag RxD	14	Rem Aud Ret	14	MIB2 D-	14	AUX2 P Enb
						15	GND	15	P GND
						16	MIB2 S+	16	R100A TxD+
						17	GND	17	P GND
						18	MIB2 S-	18	R100A TxD-
						19	CANBUS+	19	P GND
						20	Chassis GND	20	R100A RxD+
								21	P GND
								22	R100 RxD-
								23	P GND
								24	
								25	Chassis GND
								26	Chassis GND

PSL (X20)	
Pin	Signal
1	GND
2	PWR

Network (X14)	
Pin	Signal
1	Tx+
2	Tx-
3	Rx+
6	Rx-

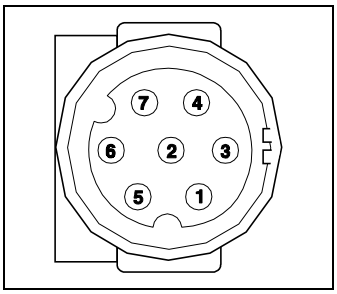

Figure B-9 PodPort Connector (see Table B-9)

Table B-9 PodPort Connector Pinouts

Pin No.	Signal
1	TXDATA+
2	NC
3	TXDATA-
4	RXDATA+
5	POD GND
6	POD PWR
7	RXDATA-
8,9	POD1 SHD

Appendix C: Error and Diagnostic Codes

1 Introduction

This section describes startup, diagnostic, and error messages produced by SC6002XL Patient Monitors. Codes listed in this appendix are typical. Codes are sometimes different, however, in different versions of SW.

1.1 Startup Messages

Upon power-up, the monitor runs internal diagnostics that check various functions. The Startup Screen remains in place for several seconds after the last message. All hardware and software for the various functions checked is assumed to be functioning properly if no error messages display during the startup sequence.

1.2 Diagnostic Log

Messages stored in the Diagnostic Log refer to startup diagnostics, hardware and software errors, and designated exception conditions such as a user-initiated language change. Some diagnostic codes, such as "Software Option Unlocked" are only informational and require no action. Classes of Error/Diagnostic codes are as follows:

- Power-Up
- MPC821 (Main Processor)
- PSOS
- Front End
- Diagnostic
- Taskmail
- Peripherals
- Database
- NBP
- SpO2
- User Interface
- Data Processing
- High Temperature
- Language Change
- Software Update
- Network
- Software Option Unlocked
- etCO2

To access the Diagnostic Log, select BIOMED on the Main menu and then DIAG. LOG.

Diagnostic Log messages have the form --

The four-digit hexadecimal code can help service personnel identify a subassembly or module that may need to be replaced in a malfunctioning monitor and provide quick remedial action. Specific codes help developers diagnose the actual cause of a problem. The first 80 entries in the Log can be printed on a Recorder by pressing the Record key while the diagnostic log is displayed. Logs may also be downloaded onto a PC by setting up the PC and connecting it to the monitor as described in either Section 5.17.1 or Section 5.17.2 of Chapter 3, and using the following procedure:

1) Do either of the following as required:
   - If monitor equipped with interface plate, plug other end of cable into X7 on interface plate.
   - If monitor mounted on docking station or INFINITY Docking Station, plug other end of cable into X3 on CPS or IDS.
2) Plug in monitor power adapter and power-up monitor.
3) After *MAIN* screen displays on monitor, press <Esc> on PC/laptop keyboard.

SC6002XL SUPPORT MENU	
00) Error Display	01)Event Log
02) Database Defaults	03)Real-time Clock
04) Set EEPROM H/W Rev.	05)Set NBP Constants
06) Verify NBP Constants	07)Display Service Data
Press ENTER to exit	

Table C-1 Support Menu (Item numbers may differ between different versions of installed software.)

4) When SC6002XL SUPPORT MENU displays, select option **0**, Error Display and press <Enter>.
5) Either press any key if more than one page, until prompt "Enter <R> to Reset Buffer, <CR> to exit appears, or press **E** to print to end of file.
6) Save file on floppy disk.

   Note: If Win95 installed on PC or laptop, include date in file name.

1.3 Severity Codes

Error Severity listed in the Diagnostic Log are interpreted as follows:

Type	Code	Result
Note	0	-- not an error -Informational only
Warning	1	-- error logged, no sys reset
Fatal	2	-- from non-interrupt code, sys reset
Trap	3	-- from interrupt code, sys reset
Diagnostic	4	-- from diagnostics, diag mst on display
Database	5	-- like fatal error, with db factory reset
Shutdown	6	-- shuts down everything except the monitor

1.4 Reset Causes

-- used to define reset cause slot in error buffer.

Power-up	0	Low-voltage Shutdown	5
SW Trap Error	1	Debug Shutdown	6
Watchdog	2	Language Change	7
3-min. Timeout	3	SW Option Unlocked	8
High-temp Shutdown	4	SW Watchdog	9

2 Diagnostic Messages

Note: Messages listed in Table C-2 are only informational.

Table C-2 Startup Diagnostic Log Codes

Description	Code	Class
MONITOR_POWERUP	0x0000	Power-Up
SOFTWARE_VERSION_CHANGE	0x0001	Software Update
USER_LANGUAGE_CHANGE	0x0002	Language Change
ARRHYTHMIA_UNLOCKED	0x0003	Software Option Unlocked
NEONATAL_UNLOCKED	0x0004	Software Option Unlocked
TEMP_ALARMS_UNLOCKED	0x0005	Software Option Unlocked
DEMO_SOFTWARE_UNLOCKED	0x0006	Software Option Unlocked
SC9015_UNLOCKED	0x0007	Software Option Unlocked
OCRG_UNLOCKED	0x0008	Software Option Unlocked
NCO_UNLOCKED	0x0009	Software Option Unlocked
SECOND_IBP_UNLOCKED	0x000A	Software Option Unlocked
ST_SEGMENT_UNLOCKED	0x000B	Software Option Unlocked
OLYMPUSNET_UNLOCKED	0x000C	Software Option Unlocked
ETCO2_UNLOCkED	0x000D	Software Option Unlocked

Table C-3 Exception Messages

Description	Code	Class
SVC_PARAM_ERROR	0x0801	MPC821
BUS_ERROR_CODE	0x0802	MPC821
ADDR_ERROR_CODE	0x0803	MPC821
ILL_INST_CODE	0x0804	MPC821
ZERO_DIVIDE_CODE	0x0805	MPC821
CHK_INST_CODE	0x0806	MPC821
TRAPV_INST_CODE	0x0807	MPC821
PRIV_VIOLATION_CODE	0x0808	MPC821
TRACE_CODE	0x0809	MPC821
UNASSIGNED_CODE	0x080C	MPC821
SPURIOUS_CODE	0x080D	MPC821
TRAPS_CODE	0x080E	MPC821
UNUSED_VECTOR_CODE	0x080F	MPC821
EXC_RESET	0x0810	MPC821

Table C-3 Exception Messages (Continued)

Description	Code	Class
EXC_MACH_CK	0x0802	MPC821
EXC_DA	0x0811	MPC821
EXC_IA	0x0812	MPC821
EXC_INTRPT	0x0813	MPC821
EXC_ALIGN	0x0814	MPC821
EXC_PROGRAM	0x0815	MPC821
EXC_FLOAT	0x0816	MPC821
EXC_DCRMNTR	0x0817	MPC821
EXC_SYSCALL	0x0818	MPC821
EXC_TRACE	0x0809	MPC821
EXC_FP821	0x0819	MPC821
EXC_SEI821	0x0804	MPC821
EXC_IMTLB821	0x0820	MPC821
EXC_DMTLB821	0x0821	MPC821
EXC_IETLB821	0x0822	MPC821
EXC_DETLB821	0x0823	MPC821
EXC_DA_BP821	0x0824	MPC821
EXC_IA_BP821	0x0825	MPC821
EXC_PBK821	0x0826	MPC821
EXC_NMIBK821	0x0827	MPC821
EXC_BUS_ERR	0x0828	MPC821

Table C-4 Hardware-related Messages

Description	Code	Class
IM_SPURIOUS_INTERRUPT	0x082f	MPC821
BAD_DATE_FORMAT	0x0830	PERIPHERALS
BAD_TIME_FORMAT	0x0831	PERIPHERALS
RTC_HARDWARE_PROBLEM	0x0832	PERIPHERALS
HW_WATCHDOG_TIMEOUT	0x0833	MPC821
NP_3_MIN_TIMEOUT	0x0834	NBP
NP_OVERPRESSURE_OCCURRED	0x0835	NBP
HW_PUMP_OR_VALVE_FAILURE	0x0836	NBP
PSOS_TIME_NOT_SET	0x0837	DATA_PROCESSING

Table C-4 Hardware-related Messages (Continued)

Description	Code	Class
SHUTDOWN_BATTERY_VOLTAGE_LOW	0x0838	PERIPHERALS
BATTERY_CHARGE_RATE_ERROR	0x0839	PERIPHERALS
BATTERY_DISCHARGE_RATE_ERROR	0x083A	PERIPHERALS
SHUTDOWN_TEMPERATURE_TOO_HIGH	0x083B	HIGH_TEMPERATURE
MARGINAL_PCMCIA_BATTERY	0x083C	PERIPHERALS
PSN_CONNECT_CONFLICT	0x083D	NETWORK
BAD_HW_REVISION	0x083E	PERIPHERALS
TEMPERATURE_TOO_LOW	0x083F	DATA_PROCESSING
HDLC_ERROR_LIMIT_EXCEEDED	0x0840	NETWORK
OLYNET_TIME_CHANGE	0x0841	NETWORK
RTC_BEING_READ	0x0842	PERIPHERALS
SW_WATCHDOG_TIMEOUT	0x0843	MPC821
SYS_TRACEBACK	0x0844	DIAGNOSTIC

Table C-5 Intertask Mail Messages

Description	Code	Class
ERROR_WORDCOUNT_ZERO	0x0850	TASKMAIL
ERROR_FULL_QUEUE	0x0851	TASKMAIL
STATUS_EMPTY_QUEUE	0x0852	TASKMAIL
ERROR_NOT_ENOUGH_BUFFER	0x0853	TASKMAIL
ERROR_BAD_QUEUE_ID	0x0854	TASKMAIL

Table C-6 Miscellaneous Messages

Description	Code	Class
PSOS_TIMER_ERROR	0x08E1	PSOS
BAD_FRONTEND_TYPE	0x08E2	FRONTEND
BAD_SCC1_STATE	0x08E3	NETWORK
SID_ERROR	0x08E4	DATA_PROCESSING
PID_ERROR	0x08E5	DATA_PROCESSING
PBOX_ERROR	0x08E6	DATA_PROCESSING
INVALID_BP_LABEL	0x08E7	DATA_PROCESSING
ILLEGAL_DATABASE_ACTIVITY	0x08E8	DATABASE
BAD_ARRHY_EVENT	0x08E9	DATA_PROCESSING
PSOS_ERROR	0x08EA	PSOS

Table C-7 Alternative Memory Manager to PSOS OSL Messages

Description	Code	Class
EXT_OSL_BAD_TASK_ID	0x0700	PSOS
EXT_OSL_INIT_FAILED	0x0701	PSOS
EXT_OSL_STACK_OVERRUN	0x0702	PSOS
EXT_OSL_NULL_LIST	0x0703	PSOS
EXT_OSL_BAD_LIST	0x0704	PSOS
EXT_OSL_BAD_PARAM	0x0705	PSOS
EXT_OSL_LIST_CORRUPT	0x0706	PSOS
EXT_OSL_EMPTY_SEARCH	0x0707	PSOS
EXT_OSL_NULL_NODE	0x0708	PSOS
EXT_OSL_NODE_ALREADY_REMOVED	0x0709	PSOS
EXT_OSL_NO_BLOCKS	0x070a	PSOS
EXT_OSL_BAD_PGROUP	0x070b	PSOS
EXT_OSL_NO_PID	0x070c	PSOS
EXT_OSL_NOT_A_BLOCK	0x070d	PSOS
EXT_OSL_Q_MSG_RECEIVED	0x070e	PSOS
EXT_OSL_BAD_QID	0x070f	PSOS
EXT_OSL_Q_TIMEOUT	0x0710	PSOS
EXT_OSL_Q_FULL	0x0711	PSOS
EXT_OSL_BAD_QMODE	0x0712	PSOS
EXT_OSL_BAD_INDEX	0x0713	PSOS
EXT_OSL_BAD_TASK_GROUP	0x0714	PSOS
EXT_OSL_BAD_TASK_PRIORITY	0x0715	PSOS
EXT_OSL_IDLE_TASK	0x0716	PSOS
EXT_OSL_BAD_SEM_ID	0x0717	PSOS
EXT_OSL_BAD_FLAG_ID	0x0718	PSOS
EXT_OSL_BAD_ENTITY	0x0719	PSOS
EXT_OSL_EXCESSIVE_DELAY	0x0720	PSOS
EXT_OSL_ILLEGAL_CALL_IN_PREOS	0x0721	PSOS
EXT_OSL_ILLEGAL_CALL_IN_INTR	0x0722	PSOS
EXT_OSL_INVALID_FREE_PTR	0x0723	PSOS
EXT_OSL_FREE_BLOCK_OVERLAP_PREV	0x0724	PSOS
EXT_OSL_FREE_BLOCK_OVERLAP_NEXT	0x0725	PSOS

Table C-7 Alternative Memory Manager to PSOS OSL Messages (Continued)

Description	Code	Class
EXT_OSL_INVALID_POOL_ID	0x0726	PSOS
EXT_OSL_INVALID_NBYTES	0x0727	PSOS
EXT_OSL_OUT_OF_MEMORY	0x0728	PSOS
EXT_OSL_CORRUPT_BLOCK	0x0729	PSOS
EXT_OSL_COPROC_FAILURE	0x0730	PSOS

Table C-8 NP Subsystem Messages

Description	Code	Class
BAD_FEATURE_ID	0x6001	DATABASE
BAD_DB_OFFSET	0x6002	DATABASE
NP_DBG_ERROR	0x6600	DATABASE
NP_DBP_ERROR	0x6700	DATABASE
ERROR_BAD_SP_ACTION	0x6100	NBP
ERROR_BAD_SP_INPUT	0x6101	NBP
ERROR_BAD_SP_STATE	0x6102	NBP
AD_CAL_FAILURE	0x6103	NBP
OVERPRESS_TEST_FAIL	0x6104	NBP
OVERPRESS_WONT_CLEAR	0x6105	NBP
PING_PONG_UNDERFLOW	0x6106	NBP
ERROR_BAD_AUTO_ZERO	0x6107	NBP
ERROR_BAD_VALVE_SETTING	0x6108	NBP
SHORT_TERM_INDEX_TOO_LARGE	0x6109	NBP
PROFILE_INDEX_TOO_LARGE	0x610A	NBP
BAD_PULSE_EXTRACT_STATE	0x610B	NBP
BAD_USER_MODE	0x610C	NBP
BAD_V3_MODULATION_GAIN	0x610D	NBP
BAD_NP_CP2SP_MSGTYPE	0x610E	TASKMAIL
BAD_MEAS_TYPE	0x610F	NBP
TOO_MANY_PULSES	0x6110	NBP
SP_BAD_PULSE_LIST	0x6111	NBP
SP_BAD_TIME_BASED_LIST	0x6112	NBP
BAD_TREND_STATE	0x6113	NBP
BAD_PULSE_COUNT	0x6114	NBP

Table C-8 NP Subsystem Messages (Continued)

Description	Code	Class
BAD_SMOOTHING_TYPE	0x6115	NBP
SP_BAD_PULSE_INDEX	0x6116	NBP
PROFILE_INDEX_TOO_SMALL	0x6117	NBP
BAD_CUFF_PRESS_INDEX	0x6118	NBP
TOO_MANY_TIME_BASED_PULSES	0x6119	NBP
TOO_MANY_EVEN_SAMPLE_POINTS	0x611A	NBP
BAD_EVEN_SAMPLE_AMP	0x611B	NBP
SP_SINGULAR_MATRIX	0x611C	NBP
SP_LINK_DOWN	0x611D	NBP
SP_RAPID_ROC	0x611E	NBP
SW_OVERPRESSURE_OCCURED	0x611F	NBP
CROSSOVER_OVERRUN	0x6120	NBP
CROSSOVER_TIMEOUT	0x6121	NBP
ICV_CALC_PROBLEM	0x6122	NBP
BAD_COLLECT_DEFINE	0x6123	NBP
BAD_EVAL_REQUEST	0x6124	NBP
AD_DISCONTINUTIY	0x6125	NBP
AD_VALUE_OOR_HIGH	0x6126	NBP
AD_VALUE_OOR_LOW	0x6127	NBP
AD_NO_ACTIVITY	0x6128	NBP
BAD_CF2SP_MSGTYPE	0x6129	TASKMAIL
BAD_EVAL_STATE	0x612A	NBP
BAD_EVAL_STATUS	0x612B	NBP
CF_TIMER_EXPIRED	0x612C	NBP
CF_RQ_BLK_STILL_ACTIVE	0x612D	NBP
BAD_PNEUM_STATE	0x612E	NBP
PNEUM_CHAR_FAILED	0x612F	NBP
HW_SAFETY_TIMER_EXPIRED	0x6130	NBP
HW_SAFETY_TIMED_OUT_IN_CAL	0x6131	NBP
BAD_INFLATION_LIMIT	0x6132	NBP
ERROR_BAD_AC2NP_MSGTYPE	0x6300	TASKMAIL
ERROR_BAD_SP2CP_MSGTYPE	0x6301	TASKMAIL

Table C-8 NP Subsystem Messages (Continued)

Description	Code	Class
ERROR_BAD_MO2NP_MSGTYPE	0x6302	TASKMAIL
ERROR_BAD_NP2AC_MSGTYPE	0x6303	TASKMAIL
ERROR_BAD_CP2SP_MSGTYPE	0x6304	TASKMAIL
ERROR_BAD_MC_INPUT	0x6305	NBP
ERROR_BAD_MC_STATE	0x6306	NBP
ERROR_BAD_MC_ACTION	0x6307	NBP
ERROR_BAD_MC_QUEUE	0x6308	TASKMAIL
NPCOOR_BAD_EF_IMAGE	0x6309	DIAGNOSTIC
SP2CP_RING_DEQUEUE_ERROR	0x630A	TASKMAIL
BAD_SP2CF_MSGTYPE	0x6500	TASKMAIL
CF_SINGULAR_MATRIX	0x6501	NBP
SP2CF_PROBLEM	0x6502	TASKMAIL
NPCF_BAD_EF_IMAGE	0x6503	DIAGNOSTIC
CF2SP_RING_DEQUEUE_ERROR	0x6504	TASKMAIL

Table C-9 Diagnostic Messages

Description	Code	Class
DIAG_ERROR_NON_PRESERVED_RAM	0x0901	DIAGNOSTIC
DIAG_ERROR_PRESERVED_RAM	0x0902	DIAGNOSTIC
DIAG_ERROR_LITHIUM_BATTERY_DEAD	0x0903	DIAGNOSTIC
DIAG_ERROR_BAD_CHKSUM_ADDRESS	0x0904	DIAGNOSTIC
DIAG_ERROR_STACK_OVERFLOW	0x0905	DIAGNOSTIC
DIAG_ERROR_ROM_CHECKSUM	0x0906	DIAGNOSTIC
DIAG_ERROR_NOT_ENOUGH_SAVE_AREA	0x0907	DIAGNOSTIC
DIAG_ERROR_TMS_INITIALIZATION	0x0908	DIAGNOSTIC
DIAG_ERROR_TASK_CREATION	0x0909	DIAGNOSTIC
DIAG_ERROR_TASK_INITIATION	0x090A	DIAGNOSTIC
DIAG_ERROR_QUART_INITIALIZATION	0x0B00	DIAGNOSTIC

Table C-10 INTER Messages

Description	Code	Class
DM_NO_MORE_STREAMS	0x0A01	FRONTEND
DM_INVLD_STREAM	0x0A02	FRONTEND
BAD_SCC1_EVENT	0x0A03	FRONTEND

Table C-10 INTER Messages (Continued)

Description	Code	Class
SCC1_BUFFER_NOT_FULL	0x0A04	FRONTEND
BAD_STRM_GET	0x0A10	DIAGNOSTIC
BAD_STRM_CREATE	0x0A20	DIAGNOSTIC
BAD_STRM_PUT	0x0A30	DIAGNOSTIC
SCC3_TX_BUFFERS_FULL	0x0A40	PERIPHERALS

Table C-11 Print Messages

Description	Code	Class
PRINT_BAD_EF_IMAGE	0x1001	DIAGNOSTIC
PRINT_UNDEFINED_SYSTEM_STATE	0x1002	DIAGNOSTIC
MA2PR_UNDEFINEDMSG	0x1003	TASKMAIL
MA2PR_RING_DEQUEUE_ERROR	0x1004	TASKMAIL
PR2MA_UNDEFINEDMSG	0x1005	TASKMAIL
ERROR_BAD_PRINT_INPUT	0x1006	DATA_PROCESSING
ERROR_BAD_PRINT_STATE	0x1007	DATA_PROCESSING
ERROR_BAD_PRINT_ACTION	0x1008	DATA_PROCESSING
CORD_ERROR_INV_GRID_COMBINATION	0x1009	PERIPHERALS
CORD_ERROR_TEXT_BUFFER_OVERFLOW	0x100A	PERIPHERALS
CORD_ERROR_DELAYED_TEXT_OVERFLOW	0x100B	PERIPHERALS
CORD_ERROR_INV_TEXT_FIELD	0x100C	PERIPHERALS
CORD_ERROR_INV_ANN_LINE	0x100D	PERIPHERALS
CORD_ERROR_CURVE_BUFFER_OVERFLOW	0x100E	PERIPHERALS
CORD_ERROR_INV_DATA_CONVERSION	0x100F	PERIPHERALS
CORD_ERROR_INV_SPEED	0x1010	PERIPHERALS
CORD_ERROR_NOT_ENOUGH_MEMORY	0x1011	PERIPHERALS
CORD_ERROR_CMD_OVERFLOW	0x1012	PERIPHERALS
CORD_ERROR_INV_SPECIAL_TREND_PARAM_TYPE	0x1013	PERIPHERALS
CORD_ERROR_MALLOC_ERROR	0x1014	PERIPHERALS
CORD_ERROR_FREE_ERROR	0x1015	PERIPHERALS
CORD_ERROR_AR42_QUEUE_NOT_EMPTIED	0x1016	PERIPHERALS
CORD_ERROR_AR42_SEND_ERROR	0x1017	PERIPHERALS
CORD_ERROR_AR42_CONTROL_ERROR	0x1018	PERIPHERALS
CORD_ERROR_SMPL_RATE_CREATE_FAILED	0x1019	PERIPHERALS

Table C-11 Print Messages (Continued)

Description	Code	Class
CORD_ERROR_SMPL_RATE_DESTROY_FAILED	0x101A	PERIPHERALS
CORD_ERROR_SMPL_RATE_CONVERSION_FAILED	0x101B	PERIPHERALS
SMPL_INPUT_BUF_TOO_LARGE	0x101C	PERIPHERALS
SMPL_INVALID_RATIO	0x101D	PERIPHERALS
SMPL_INVALID_FIDELITY	0x101E	PERIPHERALS
SMPL_CREATE_FAILED	0x101F	PERIPHERALS
PRINT_NO_ALARM_MESSAGE	0x1020	DATA_PROCESSING
PRINT_DB_ERROR	0x1040	DATABASE
PRINT_OUT_OF_MEMORY	0x1041	DATA_PROCESSING
PRINT_BAD_RECORDER_MESSAGE	0x1042	PERIPHERALS
PRINT_BAD_STORAGE_AREA	0x1043	DATA_PROCESSING
PRINT_BUFFERS_NOT_EMPTYING	0x1044	PERIPHERALS
CORD_STATUS_ERROR_MASK	0x1100	PERIPHERALS
LC2PR_UNDEFINEDMSG	0x1200	TASKMAIL
LC2PR_RING_DEQUEUE_ERROR	0x1201	TASKMAIL
PRINT_TLIB_CALLBACK_ERROR	0x1300	DATA_PROCESSING
PRINT_TLIB_CLOSE_ASSOC_FAILED	0x1400	DATA_PROCESSING
PRINT_TLIB_INVALID_RESPONSE	0x1401	DATA_PROCESSING
PR2LC_RING_BUFFER_FULL	0x1500	TASKMAIL
PR2MA_RING_BUFFER_FULL	0x1501	TASKMAIL

Table C-12 MAIN Processor Messages

Description	Code	Class
INVALID_SID_LABEL	0x3002	USER_INTERFACE
MA2AC_RING_BUFFER_FULL	0x3003	TASKMAIL
MA2AL_RING_BUFFER_FULL	0x3004	TASKMAIL
MA2AU_RING_BUFFER_FULL	0x3005	TASKMAIL
MAIN_INVALID_NP_MSG_TYPE	0x3006	USER_INTERFACE
AC2MA_RING_DEQUEUE_ERROR	0x3007	TASKMAIL
AL2MA_RING_DEQUEUE_ERROR	0x3008	TASKMAIL
MO2MA_RING_DEQUEUE_ERROR	0x3009	TASKMAIL
INVALID_PID_LABEL	0x300A	USER_INTERFACE
INVALID_PID_TYPE	0x300B	USER_INTERFACE

Table C-12 MAIN Processor Messages (Continued)

Description	Code	Class
INVALID_SID_TYPE	0x300C	USER_INTERFACE
MTOS_TIME_ERR	0x300D	DATA_PROCESSING
SYSTEM_STATE_ACK_FAILED	0x300E	DIAGNOSTIC
MAIN_BAD_EF_IMAGE	0x300F	DIAGNOSTIC
MA2PR_RING_BUFFER_FULL	0x3010	TASKMAIL
PR2MA_RING_DEQUEUE_ERROR	0x3011	TASKMAIL
AC2MA_UNDEFINEDMSG	0x3012	TASKMAIL
AL2MA_UNDEFINEDMSG	0x3013	TASKMAIL
NO_TECH_PRIORITY_MSG_QUEUED	0x3014	USER_INTERFACE
NO_PSMQ_BUFFERS	0x3015	USER_INTERFACE
BAD_INDEX_VALUE	0x3016	USER_INTERFACE
INVALID_LABEL_ATTRIBUTE	0x3017	USER_INTERFACE
INVALID_PBOX_TYPE	0x3018	USER_INTERFACE
INVALID_TREND_DATA	0x3019	DATABASE
INCONSISTENT_TREND_DATABASE	0x301A	DATABASE
INVALID_ALARM_GRADE	0x301F	USER_INTERFACE
INVALID_BATTERY_STATE	0x3021	USER_INTERFACE
NO_MSGS_QUEUED_FOR_DISPLAY	0x3022	USER_INTERFACE
INVALID_PCMCIA_CARD_STATE	0x3023	USER_INTERFACE
INVALID_BATTERY_LIFE_LOOKUP	0x3024	USER_INTERFACE
MA2HC_RING_BUFFER_FULL	0x3025	TASKMAIL
LINK_TIME_ERROR	0x3026	NETWORK
LINK_DATE_ERROR	0x3027	NETWORK
HC2MA_UNDEFINEDMSG	0x3028	TASKMAIL
HC2MA_RING_DEQUEUE_ERROR	0x3029	TASKMAIL
ILLEGAL_RECORDING_TYPE	0x302A	USER_INTERFACE
GUI_SWERROR_CODE	0x302B	USER_INTERFACE
ERR_NEW_PATIENT_TYPE	0x302C	DIAGNOSTIC
ERR_DOWNLOAD_COMPLETE	0x302D	DIAGNOSTIC
NP_BAD_CASE_VALUE	0x302E	NBP
SRV_CLK_BAD_CASE_VALUE	0x302F	USER_INTERFACE
MAIN_DBG_ERR	0x3100	DATABASE
MAIN_DBP_ERR	0x3200	DATABASE

Table C-13 ACT Messages

Description	Code	Class
ACTUNDEFINEDMSG	0x2801	TASKMAIL
ACT_PROG_ERROR	0x2802	DATA_PROCESSING
AC2MA_RING_BUFFER_FULL	0x2803	TASKMAIL
AC2FE_RING_BUFFER_FULL	0x2804	TASKMAIL
AC2SP_RING_BUFFER_FULL	0x2805	TASKMAIL
AC2NP_RING_BUFFER_FULL	0x2806	TASKMAIL
MA2AC_RING_DEQUEUE_ERROR	0x2807	TASKMAIL
FE2AC_RING_DEQUEUE_ERROR	0x2808	TASKMAIL
NP2AC_RING_DEQUEUE_ERROR	0x2809	TASKMAIL
SP2AC_RING_DEQUEUE_ERROR	0x280A	TASKMAIL
ACT_BAD_EF_IMAGE	0x280B	DIAGNOSTIC
AC2ET_RING_BUFFER_FULL	0x280C	TASKMAIL
AC2ET_BAD_ENQ	0x280D	TASKMAIL
ET2AC_RING_DEQUEUE_ERROR	0x280E	TASKMAIL
ACT_UNKNOWN_QRS_ARR_SETTING	0x280F	TASKMAIL
ACT_BUFFER_TOO_SMALL	0x2810	DATA_PROCESSING
ACT_PRM_UPDATE_ERROR	0x2811	DATA_PROCESSING
ACT_WRONG_MSG_FROM_ALG	0x2812	DATA_PROCESSING
ACT_CHANGE_LABEL_ERROR	0x2813	DATA_PROCESSING
AC2FE_BAD_ENQ	0x2814	TASKMAIL
AC2MA_BAD_ENQ	0x2815	TASKMAIL
ACT_BAD_ACB	0x2816	DATA_PROCESSING
ACT_NO_MORE_ALG_MSG_BUFS	0x2817	DATA_PROCESSING
ACT_BAD_SIGNAL_INDEX	0x2818	DATA_PROCESSING
ACT_BAD_LABEL	0x2819	DATA_PROCESSING
ACT_BAD_PID	0x281A	DATA_PROCESSING
ACT_BAD_DB_RETURN	0x281B	DATABASE
ACT_FEND_SYNC_PROBLEM	0x281C	FRONTEND
ACT_BAD_SYSTEM_STATE	0x281D	DIAGNOSTIC
AC2AU_RING_BUFFER_FULL	0x281E	TASKMAIL
AC2AU_BAD_ENQ	0x281F	TASKMAIL
AC2AL_RING_BUFFER_FULL	0x2820	TASKMAIL

Table C-13 ACT Messages (Continued)

Description	Code	Class
AC2AL_BAD_ENQ	0x2821	TASKMAIL
ACT_BAD_CART_MSG_IN	0x2822	DATA_PROCESSING
ACT_BAD_CART_STATE	0x2823	DATA_PROCESSING
ACT_BAD_MSG_PRI	0x2824	DATA_PROCESSING
ACT_BAD_CART_VERSION	0x2825	DATA_PROCESSING
ACT_BAD_INTL_TIME_FROM_DM	0x2826	DATA_PROCESSING
ACT_NO_SUCH_PRESS_LABEL	0x2827	DATA_PROCESSING
ACT_BAD_EKG_RECORD_STR	0x2828	DATA_PROCESSING
ACT_BAD_ALG_DIAG_REQUEST	0x2829	DATA_PROCESSING
MO2AC_RING_DEQUEUE_ERROR	0x282A	TASKMAIL
AC2MO_RING_BUFFER_FULL	0x282B	TASKMAIL
AC2MO_BAD_ENQ	0x282C	TASKMAIL
ACT_BAD_ALG_EVENT	0x282D	DATA_PROCESSING
ACT_BAD_PATIENT_TYPE	0x282E	DATA_PROCESSING
AC2HC_RING_BUFFER_FULL	0x282F	TASKMAIL
AC2HC_BAD_ENQ	0x2830	TASKMAIL
FECTRL_BAD_ENQ	0x2840	TASKMAIL
AC2NP_BAD_ENQ	0x2842	TASKMAIL
AC2SP_BAD_ENQ	0x2843	TASKMAIL
ACT_BAD_STATMSG_REQUEST	0x2900	DATA_PROCESSING
ACT_BAD_STATMSG_TYPE	0x2920	DATA_PROCESSING
NP_FAULT_NUMBER_ERROR	0x2A00	DATA_PROCESSING
SPO2_FAULT_NUMBER_ERROR	0x2B00	DATA_PROCESSING

Table C-14 Audio Messages

Description	Code	Class
AUDIOUNDEFINEDMSG	0xA801	TASKMAIL
AUDIONOTIMPLEMENTED	0xA802	USER_INTERFACE
AUDIO_UNDEFINED_EF	0xA900	DIAGNOSTIC
AUDIO_MAIL_QUEUE_ERROR	0xA901	TASKMAIL
AUDIO_MAIL_ID_ERROR	0xA902	TASKMAIL
AUDIO_MAIL_TYPE_ERROR	0xA903	TASKMAIL
AUDIO_MAIL_SIZE_ERROR	0xA904	TASKMAIL

Table C-14 Audio Messages (Continued)

Description	Code	Class
AUDIO_EVENT_QUEUE_IS_FULL	0xA905	USER_INTERFACE
AUDIO_INTERNAL_ERROR	0xA906	USER_INTERFACE
AUDIO_DB_ERROR	0xA907	DATABASE
AUDIO_UNDEFINED_VOLUME	0xA908	USER_INTERFACE
AUDIO_UNDEFINED_SYSTEM_STATE	0xA909	USER_INTERFACE
AUDIO_UNDEFINED_PULSE_SOURCE	0xA90A	USER_INTERFACE
AUDIO_ILLEGAL_FREQUENCY	0xA90B	USER_INTERFACE
AU2MA_RING_BUFFER_FULL	0xA90C	TASKMAIL
AU2MA_UNDEFINEDMSG	0xA90D	TASKMAIL
AU2MA_RING_DEQUEUE_ERROR	0xA90E	TASKMAIL

Table C-15 Database Messages

Description	Code	Class
DB_INIT_PUT_ERR	0x0D00	DATABASE
DB_INIT_GET_ERR	0x0D00	DATABASE
BAD_S730_LABEL_ENUM	0x0D21	DATABASE
BAD_S730_SPEC_CODE_ENUM	0x0D22	DATABASE
INTERNAL_DATABASE_ERROR	0x0D23	DATABASE
DB_LABEL_STRING_FAULT	0x0D24	DATABASE
DB_INIT_INVALID_FRONTEND	0x0D25	DATABASE
USER_DEFAULT_AREA_INVALID	0x0D26	DATABASE
DB_ACTION_ERR	0x0D27	DATABASE
DB_INIT_CONFIG_ERROR	0x0D30	DATABASE
DB_INIT_PAT_ERR	0x0D40	DATABASE
DB_INIT_TEMP_ERROR	0x0D50	DATABASE
USER_DEFAULT_LOAD_ERROR	0x0D60	DATABASE
USER_DEFAULT_SAVE_ERROR	0x0D70	DATABASE
DB_MAPPING_ERR	0x0D80	DATABASE

Table C-16 Front End Messages

Description	Code	Class
FENDUNDEFINEDMSG	0x7801	TASKMAIL
FE2AC_RING_BUFFER_FULL	0x7802	TASKMAIL
FECTRL_RING_BUFFER_FULL	0x7803	TASKMAIL

Table C-16 Front End Messages (Continued)

Description	Code	Class
AC2FE_MSG_ERROR	0x7804	TASKMAIL
FECTRL_MSG_ERROR	0x7805	TASKMAIL
FECTRL_DEQUEUE_ERROR	0x7806	TASKMAIL
FEND_BAD_EF_IMAGE	0x7807	DIAGNOSTIC
FEND_QUART_OVERRUN	0x7808	DIAGNOSTIC
FEND_IDLE_HDLC_DETECTED	0x7809	DIAGNOSTIC
FEND_HDLC_ERRORS	0x780a	DIAGNOSTIC
FEND_UNKNOWN_WAVEFORM_ID	0x7A01	FRONTEND
FEND_UNKNOWN_EKG_SIGNAL_INDEX	0x7A02	FRONTEND
FEND_INVALID_SIGNAL_INDEX	0x7A03	FRONTEND
FEND_UNKNOWN_ALGORITHM_CODE	0x7A04	FRONTEND
FEND_UNKNOWN_LEAD	0x7A05	FRONTEND
FEND_OUT_OF_TIMERS	0x7A06	FRONTEND
CURVE_BUF_OVERFLOW	0x7A07	FRONTEND
ALG_BUF_TOP_OVERFLOW	0x7A0A	FRONTEND
ALG_BUF_BOTTOM_OVERFLOW	0x7A0B	FRONTEND
FEND_RE_SYNC_TIME_OUT	0x7A0C	FRONTEND
FEND_FRONTEND_UNPLUGGED	0x7A0D	FRONTEND
FEND_RE_SYNC_COMPLETE	0x7A0E	FRONTEND
FEND_NOISE_IN_SYNC	0x7A0F	FRONTEND
FEND_BAD_SIGNAL_INDEX	0x7A15	FRONTEND
FEND_BAD_BLIP_CHAR	0x7A18	FRONTEND
FEND_BAD_CHANGE_LEAD_REQ	0x7A19	FRONTEND
SPO2_UART_BUFFER_SKIPPED	0x7A1A	FRONTEND
PING_PONG_OVERFLOW	0x7A20	FRONTEND
BAD_PING_PONG_STATE	0x7A21	FRONTEND
BAD_VALVE_SELECTION	0x7A22	FRONTEND
BACKGROUND_TASK_NOT_RUNNING	0x7A23	FRONTEND
FEND_COMMAND_ACK_TIMEOUT	0x7A30	FRONTEND
FEND_MINUS_5V_OUT_OF_RANGE	0x7A31	FRONTEND
FEND_PLUS_5V_OUT_OF_RANGE	0x7A32	FRONTEND
FEND_VREF_OUT_OF_RANGE	0x7A33	FRONTEND

Table C-16 Front End Messages (Continued)

Description	Code	Class
FEND_PVREF_PLUS_OUT_OF_RANGE	0x7A34	FRONTEND
FEND_PVREF_MINUS_OUT_OF_RANGE	0x7A35	FRONTEND
FEND_SPO2_25V_OUT_OF_RANGE	0x7A36	FRONTEND
FEND_TASK_SHUTDOWN	0x7A37	FRONTEND
FEND_COMMAND_ACK_WARNING	0x7A50	FRONTEND
FEND_VBUS_OUT_OF_RANGE	0x7A60	FRONTEND
FEND_12V_OUT_OF_RANGE	0x7A61	FRONTEND
FEND_18V_OUT_OF_RANGE	0x7A62	FRONTEND
FEND_MICROCONTROLLER_FAILURE	0x7A63	FRONTEND
FEND_UC_COMMAND_FAILED	0x7A64	FRONTEND
FEND_PLUS5V_OUT_OF_RANGE	0x7A65	FRONTEND
FEND_MINUS5V_OUT_OF_RANGE	0x7A66	FRONTEND
FEND_UC_BAD_COMMAND	0x7B00	FRONTEND
FEND_UC_FLASH_CORRUPTED	0x7B01	FRONTEND

Table C-17 Alarm Messages

Description	Code	Class
ALARMUNDEFINEDMSG	0x4801	TASKMAIL
AL2MA_RING_BUFFER_FULL	0x4802	TASKMAIL
AC2AL_RING_DEQUEUE_ERROR	0x4803	TASKMAIL
MA2AL_RING_DEQUEUE_ERROR	0x4804	TASKMAIL
AL2MA_BAD_ENQ	0x4805	TASKMAIL
AL2AU_RING_BUFFER_FULL	0x4806	TASKMAIL
AL2AU_BAD_ENQ	0x4807	TASKMAIL
ALRM_BAD_EF_IMAGE	0x4808	DIAGNOSTIC
ALRM_BAD_SYSTEM_STATE	0x4A01	DIAGNOSTIC
ALRM_BAD_PID	0x4A02	DATA_PROCESSING
ALRM_BAD_ON_OFF	0x4A03	DATA_PROCESSING
ALRM_BAD_PARAM_VALUE	0x4A04	DATA_PROCESSING
ALRM_BAD_APCT	0x4A05	DATA_PROCESSING
ALRM_NOT_IMPLEMENTED	0x4A06	DATA_PROCESSING
ALRM_BAD_STATE_INTERSECTION	0x4A07	DATA_PROCESSING
ALRM_BAD_SMI	0x4A08	DATA_PROCESSING

Table C-17 Alarm Messages (Continued)

Description	Code	Class
ALRM_BAD_SMS	0x4A09	DATA_PROCESSING
ALRM_BAD_DB_RETURN	0x4A0A	DATABASE
ALRM_BAD_AOCB_RQ	0x4A0B	DATA_PROCESSING
ALRM_BAD_ALARM_GRADE	0x4A0C	DATA_PROCESSING
ALRM_DB_LIST_TOO_SMALL	0x4A0D	DATA_PROCESSING
ALRM_BAD_DB_GROUP	0x4A0E	DATABASE
ALRM_BAD_AC_INDEX	0x4A0F	DATA_PROCESSING
ALRM_BAD_LIMIT_TIMER	0x4A10	DATA_PROCESSING
ALRM_OUT_OF_TIMERS	0x4A11	DATA_PROCESSING

Table C-18 Monitoring Messages

Description	Code	Class
DUMMY_WARNING_ERROR	0xB801	DIAGNOSTIC
DUMMY_FATAL_ERROR	0xB802	DIAGNOSTIC
DUMMY_TRAP_ERROR	0xB803	DIAGNOSTIC
DUMMY_DIAG_ERROR	0xB804	DIAGNOSTIC
DUMMY_DB_ERROR	0xB805	DIAGNOSTIC
DUMMY_SHUTDOWN_ERROR	0xB806	DIAGNOSTIC
AC2MO_UNDEFINED_MSG	0xB807	TASKMAIL
AC2MO_RING_DEQUEUE_ERROR	0xB808	TASKMAIL
MO2AC_RING_BUFFER_FULL	0xB809	TASKMAIL
MO2AC_BAD_ENQ	0xB80A	TASKMAIL
MO2MA_RING_BUFFER_FULL	0xB80B	TASKMAIL
PIO_READ_ERROR	0xB80C	DATA_PROCESSING
MON_DB_PUT_ERROR	0xB80D	DATABASE
MON_BAD_EF_IMAGE	0xB80E	DIAGNOSTIC

Table C-19 SpO2 Messages

Description	Code	Class
SP02_DBG_ERROR	0x5000	DATABASE
SP02_DBP_ERROR	0x5100	DATABASE
SPCOORD_BAD_EF_IMAGE	0x5201	DIAGNOSTIC
SPCOORD_UNDEFINED_SYSTEM_STATE	0x5202	SPO2
AC2SP_UNDEFINEDMSG	0x5203	TASKMAIL

Table C-19 SpO2 Messages (Continued)

Description	Code	Class
AC2SP_RING_DEQUEUE_ERROR	0x5204	TASKMAIL
UNSUPPORTED_CASE	0x5205	SPO2
BAD_STATE_SEQUENCE	0x5206	SPO2
UNPLUGGED_STATE_ERROR	0x5207	SPO2
REGULATING_STATE_ERROR	0x5208	SPO2
MEASURING_STATE_ERROR	0x5209	SPO2
UNSUPPORTED_MSG_TYPE	0x520A	TASKMAIL
UNSUPPORTED_DATA_TYPE	0x520B	TASKMAIL
REGULATION_TIMEOUT	0x520C	SPO2
VALIDATION_TIMEOUT	0x520D	SPO2
VALIDATION_ERROR	0x520E	SPO2
CALIBRATION_ERROR	0x520F	SPO2
CALIBRATION_TIMEOUT	0x5210	SPO2
SPO2_INVALID_MAIL_QUEUE	0x5211	TASKMAIL
SPO2_ENQUEUE_ERROR	0x5212	TASKMAIL
SP_VR2CT_UNDEFINEDMSG	0x5213	TASKMAIL
SP_VR2CT_RING_DEQUEUE_ERROR	0x5214	TASKMAIL
SP_PR2CT_UNDEFINEDMSG	0x5215	TASKMAIL
SP_PR2CT_RING_DEQUEUE_ERROR	0x5216	TASKMAIL
SP_CS2CT_UNDEFINEDMSG	0x5217	TASKMAIL
SP_CS2CT_RING_DEQUEUE_ERROR	0x5218	TASKMAIL
UNSUPPORTED_ALARM_TYPE	0x5219	SPO2
MO2SP_UNDEFINEDMSG	0x521A	TASKMAIL
MO2SP_RING_DEQUEUE_ERROR	0x521B	TASKMAIL
SPO2_EXCESS_OFFSET	0x521C	SPO2
SPO2_ILLEGAL_DEBUG_COUNT	0x521D	SPO2
SP_CT2VR_UNDEFINEDMSG	0x5301	TASKMAIL
SPVRM_BAD_EF_IMAGE	0x5302	DIAGNOSTIC
SP_CT2CS_UNDEFINEDMSG	0x5401	TASKMAIL
SPCS_BAD_EF_IMAGE	0x5402	DIAGNOSTIC
SP_CT2CP_UNDEFINEDMSG	0x5501	TASKMAIL
SPCPR_BAD_EF_IMAGE	0x5502	DIAGNOSTIC

Table C-20 HCOM Messages

Description	Code	Class
LC2HC_RING_BAD_MESSAGE	0x5801	DATA_PROCESSING
HC2MA_RING_BUFFER_FULL	0x5802	TASKMAIL
HC2LC_RING_BUFFER_FULL	0x5803	TASKMAIL
MA2HC_RING_DEQUEUE_ERROR	0x5804	TASKMAIL
LC2HC_RING_DEQUEUE_ERROR	0x5805	TASKMAIL
HC2LC_CONTROL_BUFFER_FULL	0x5806	TASKMAIL
AGS_MESSAGE_LOGGED_INCORRECTLY	0x5807	DATA_PROCESSING
HC2LC_EVENT_BUFFER_FULL	0x5808	TASKMAIL
AGS_MESSAGE_SLOTS_FULL	0x5809	DATA_PROCESSING
DISTRIBUTION_Q_ERR	0x580A	TASKMAIL
AGS_NDO_FORMAT_ERROR	0x580B	DATA_PROCESSING
AGS_SAME_DEVICE_ID	0x580C	DATA_PROCESSING
BAD_HCOM_EVENT_FLAG	0x580D	TASKMAIL
BAD_SPECIAL_CODE	0x580E	DATA_PROCESSING
HCOM_BAD_WVF_SCALE_FACTOR	0x580F	DATA_PROCESSING
HCOM_WVF_TAKER_TOO_CLOSE	0x5810	DATA_PROCESSING
HCOM_WVF_TAKER_TOO_FAR	0x5811	DATA_PROCESSING
BAD_DATABASE_MBR	0x5812	DATA_PROCESSING
HCOM_NET_STATE_INCONSISTENT	0x5813	DATA_PROCESSING
BAD_SIGNAL_GROUP	0x5814	DATA_PROCESSING
HCOM_BAD_MTOS_MONTH	0x5815	DATA_PROCESSING
HCOM_ENQUEUE_ERROR	0x5816	TASKMAIL
HCOM_BAD_MAIN_MESSAGE	0x5817	TASKMAIL
HCOM_TLIB_WRITE_ERROR	0x5818	NETWORK
HCOM_TIME_LIST_OVF	0x5819	NETWORK
HCOM_TIME_SERV_BAD_IP	0x581A	NETWORK
HCOM_TLIB_MULTICAST_OVERRUN	0x581B	NETWORK
HCOM_PUT_ERR	0x5900	DATABASE
HCOM_GET_ERR	0x5A00	DATABASE

Table C-21 LCOM Messages

Description	Code	Class
TLIB_OPEN_ASSOC_FAILED	0x6801	NETWORK
TLIB_CLOSE_INDICATION_FAILED	0x6802	NETWORK
ERROR_ENQUEUEING_MSG	0x6803	TASKMAIL
ERROR_DEQUEUEING_MSG	0x6804	TASKMAIL
ILLEGAL_EVENT_FLAG	0x6805	DIAGNOSTIC
INVALID_LCOM_STATE	0x6806	DATA_PROCESSING
LCOM_STATUS_REQ_ERROR	0x6807	DATA_PROCESSING
CNTRL_UNDEFINED_MSG	0x6808	TASKMAIL
TLIB_HDLC_SEND_FAILED	0x6809	NETWORK
TLIB_INVALID_FLOW_STATE	0x680A	NETWORK
TLIB_WRITE_INDICATION_FAILED	0x680B	NETWORK
TLIB_CLOSE_ASSOC_FAILED	0x680C	NETWORK
PR2LC_RING_DEQUEUE_ERROR	0x680D	TASKMAIL
PR2LC_UNDEFINEDMSG	0x680E	TASKMAIL
TLIB_ACCEPT_ASSOC_FAILED	0x680F	NETWORK
INVALID_ACS_DESCRIPTOR	0x6810	DATA_PROCESSING
INVALID_ACS_CONTROL_REQUEST	0x6811	DATA_PROCESSING
INVALID_ACS_NDO_TYPE	0x6812	DATA_PROCESSING
INVALID_ACS_BUFFER	0x6813	DATA_PROCESSING
RPC_CONFIG_REQUEST_FAILED	0x6814	NETWORK
BAD_TLIB_CALLBACK	0x6815	NETWORK
UNTERMINATED_UNICODE_MSG	0x6816	DATA_PROCESSING
UNICODE_MSG_OVERRUN	0x6817	DATA_PROCESSING
TLIB_RPC_DECODE_FAILED	0x6818	NETWORK
TLIB_CALLBACK_FAILED	0x6819	NETWORK
INVALID_ACS_DID_ITEM	0x681A	DATA_PROCESSING
TMS_WRITE_FAILED	0x681B	NETWORK
INVALID_ACS_DATA_REQUEST	0x681C	DATA_PROCESSING
NS_ADVERTISEMENT_NOT_BUILT	0x681D	NETWORK
NS_VERSION_MISMATCH	0x681E	NETWORK
NS_MSG_OVERRUN	0x681F	NETWORK
NS_MSG_UNDERRUN	0x6820	NETWORK

Table C-21 LCOM Messages (Continued)

Description	Code	Class
NS_INVALID_RECORD	0x6821	NETWORK
NS_INVALID_ACTION	0x6822	NETWORK
NS_INVALID_MESSAGE	0x6823	NETWORK
RPC_INVALID_CONFIG_ITEM	0x6824	NETWORK
RPC_INVALID_CONFIG_REPLY	0x6825	NETWORK
NS_ADVERTISEMENT_NOT_SENT	0x6826	NETWORK
NS_RECORDER_QUERY_FAILED	0x6827	NETWORK
TLIB_EXCEPTION_INDICATION	0x6828	NETWORK
TLIB_WRITE_INDICATION	0x6829	NETWORK
TLIB_GATEWAY_DOWN_INDICATION	0x682A	NETWORK
TLIB_CLOSE_INDICATION	0x682B	NETWORK
TLIB_READ_INDICATION	0x682C	NETWORK
AGS_READ_FAILED	0x682D	NETWORK
TMS_READ_FAILED	0x682E	NETWORK
ACS_INVALID_DID	0x682F	NETWORK
ACS_INVALID_DATA_TYPE	0x6830	NETWORK
ACS_INVALID_ACTION	0x6831	NETWORK
ACS_MSG_OVERRUN	0x6832	NETWORK
ACS_WRITE_FAILED	0x6833	NETWORK
ACS_READ_FAILED	0x6834	NETWORK
ACS_KEEP_ALIVE_FAILED	0x6835	NETWORK
ACS_TREND_ODD_MSG_LENGTH	0x6836	NETWORK
ACS_TREND_INVALID_DATA	0x6837	NETWORK
ACS_TREND_INVALID_PID	0x6838	NETWORK
ACS_TREND_INVALID_TIME	0x6839	NETWORK
ACS_TREND_INVALID_RQST	0x683A	NETWORK
ACS_BAD_PARAMETER	0x683B	NETWORK
NS_INVALID_DEVICE	0x683C	NETWORK
ACS_MAX_ASSOCS_EXCEEDED	0x683D	NETWORK
AGS_WRITE_FAILED	0x683E	NETWORK
PDS_WRITE_FAILED	0x683F	NETWORK
RPC_CONFIG_MODIFY_FAILED	0x6840	NETWORK
RPC_VERSION_MISMATCH	0x6841	NETWORK

Table C-21 LCOM Messages (Continued)

Description	Code	Class
RPC_STRING_FORMAT_ERROR	0x6842	NETWORK
RPC_READ_FAILED	0x6843	NETWORK
NS_BED_QUERY_FAILED	0x6844	NETWORK
DATA_XFER_SLOTS_FULL	0x6845	DATA_PROCESSING
LCOM_DB_GET_ERROR	0x6850	DATA_PROCESSING
LCOM_DB_PUT_ERROR	0x6860	DATA_PROCESSING
LC2PR_RING_BUFFER_FULL	0x6880	TASKMAIL
HDLC_RCV_PROCESS_ERROR	0x6901	NETWORK
HDLC_INVALID_PROTOCOL	0x6902	NETWORK
HDLC_RCV_BYTES_DROPPED	0x6903	NETWORK
HDLC_NO_XMT_BUFFERS	0x6904	NETWORK
HDLC_IRQ_PROCESS_ERROR	0x6980	NETWORK

Table C-22 NET Messages

Description	Code	Class
NET_UNDEFINED_NLAYER_TYPE	0xE001	NETWORK
NET_DUPLICATE_ARP_IP	0xE002	NETWORK
NET_BAD_IP_HDR	0xE003	NETWORK
NET_BAD_IP_CKSUM	0xE004	NETWORK
NET_IP_UNKNOWN_OPTIONS	0xE005	NETWORK
NET_UNDEFINED_TLAYER_PROT	0xE006	NETWORK
NET_BAD_TLAYER_CKSUM	0xE007	NETWORK

Table C-23 etCO2 Messages

Description	Code	Class
ERROR_BAD_ETCO2_QUEUE	0x2C00	TASKMAIL
ERROR_BAD_ETCO2_MSGTYPE	0x2C01	TASKMAIL
ET2AC_RING_BUFFER_FULL	0x2C02	TASKMAIL
ET2AC_BAD_ENQ	0x2C03	TASKMAIL
ETCO2_UNSUPPORTED_OPCODE	0x2C04	ETCO2
ETCO2_IMPOSSIBLE_STATE	0x2C05	ETCO2
ETCO2_UNKNOWN_RESPONSE	0x2C06	ETCO2
ETCO2_QUEUE_PROBLEM	0x2C07	TASKMAIL
ETCO2_BAD_GDO_DATA	0x2C08	ETCO2

Table C-23 etCO2 Messages

Description	Code	Class
ETCO2_ILLEGAL_TRANSITION	0x2C09	ETCO2
ETCO2_POD_FAILED	0x2C0A	ETCO2
ETCO2_WVF_UNDERFLOW	0x2C0B	TASKMAIL
ETCO2_BAD_SENSOR_TEMP	0x2C0C	ETCO2
ETCO2_BAD_SENSOR_CURRENT	0x2C0D	ETCO2
ETCO2_BAD_SENSOR_CALIB	0x2C0E	ETCO2
ETCO2_UNSUPPORTED_DPI	0x2C0F	ETCO2
ETCO2_COMM_ERROR	0x2C10	ETCO2
ETCO2_UNKNOWN_RSP_STATE	0x2C11	ETCO2
ETCO2_WVF_OVERFLOW	0x2C12	ETCO2
ERROR_BAD_ET_INPUT	0x2C13	ETCO2
ERROR_BAD_ET_STATE	0x2C14	ETCO2
ETCO2_RING_BUFFER_FULL	0x2C15	ETCO2
ERROR_ETCO2_EVAFTER_FAIL	0x2C16	ETCO2
ETCO2_NO_TIMERS_IDENTIFIED	0x2C17	ETCO2
ET2ET_BAD_ENQ	0x2C18	TASKMAIL

Appendix D: Functional Verification Checklist

Site: _____ Date: _____ Technician: _____

Location: _____Monitor Serial Number: _____ Installed SW Version: _____

File a copy of this report with site documentation, and retain a copy for your records. The Siemens LG may also require a copy of these test results.

✔ = Function OK

1.1 Power Circuits and Startup _____

1.2 Optical Encoder _____

1.3 TFT-LCD Display _____

1.4 Fixed Keys _____

1.5 ECG/Resp _____

1.6 Asystole _____

1.7 SpO_2 _____

1.8 Temperature _____

1.8.1 Functional Verification _____

1.8.2 Calibration Check (if required)

Resistance Setting (Ω)	Set Temperature	Monitor Reading	Tolerance	Pass
6990	1.0		0.9 to 1.1	
3539	15.0		14.9 to 15.1	
1355	37.0		36.9 to 37.1	
843.2	49.0		48.9 to 49.1	

1.9 $etCO_2$ (if installed) _____

1.10 Non-Invasive Blood Pressure _____

1.11 Invasive Blood Pressure _____

2 Leakage Current Test _____

- Combined Lead leakage_____
- Individual Lead leakage_____
- Paired Lead leakage_____
- Leakage with Line Voltage on Leads_____

3 NBP Calibrated Date _____

Monitor has passed all required tests.

_____ _____

Siemens Representative Date

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Appendix E: Supplemental Documents

This Appendix contains copies of two typical service documents that relate to processes that may well be required after replacing some of the subassemblies in the monitor. Formatting of the documents has been changed to conform to the formatting of this Manual, and some ancillary information has been omitted. Also, page numbers have been changed to be sequential in this Manual. The Doc. Nos. listed are the numbers of the original documents. Subsequent revisions of these documents may contain additional or revised information. It is recommended that copies of service documents distributed to the field from time to time throughout the life of the product, be retained with this Service Manual.

- Software Installation Instructions - Software Version VE0

  Doc. No. A91004-M3330-T944-01-7600

- Service Setup Instructions - VE0 Software

  Doc. No. A91004-M3330-T940-01-7600

Software Installation Instructions - Software Version VE0

1 Introduction

An SC6002XL Portable Patient Monitor is shipped with software installed. Software upgrades using PCMCIA memory cards, however, can be performed in the field.

Note: PCMCIA cards are recyclable. When the card is of no further use, recycle in accordance with local regulations, or return it to the factory in its original shipping carton.

Upgrading software is a password-protected function, requiring use of both a Biomed and a Service password. The Service menu is accessed via the Biomed selection in the Monitor setup.

Caution

The upgrade procedure copies the contents of the PCMCIA card to the monitor flash memory. It is important to avoid power interruptions during the upgrade process. Be sure that there is at least a 50% charge level in the battery or that the power adapter is connected. The monitor must NOT be connected to a Docking Station™ while software is being upgraded.

2 Kit Contents

In addition to documentation, the upgrade kit contains the following:

- One - PCMCIA Memory Card in Return Case
- One set - S/W Version Labels

3 Software upgrade procedure

1) Remove all patient inputs and power-down monitor.
2) Insert and firmly seat PCMCIA card into memory slot.

   NOTE: The card can be fully inserted in only one orientation, and the eject button is pushed out when the card is properly seated.
3) Turn monitor power on.
4) Verify software version VE0.1 is displayed on startup screen.

   Note: Software version can also be identified after bootup. At Main Screen depress Menu button, select Monitor Setup → Biomed. Turn rotary knob to 375, depress knob and select Diagnostic Log. The software version is displayed to the right of "Description" heading.
5) At Main Screen depress Menu button, select Monitor Setup → Biomed. Turn rotary knob to 375 and depress knob.
6) Select Service, turn rotary knob to 4712 and depress knob.
7) Select Update Software-Load and depress knob.

The screen goes into download mode. After a few seconds, a down counter starts, showing the number of sectors that still need to be burned on the flash memory. Once the download is complete, the monitor turns itself off.

8) Press eject button and remove PCMCIA card.
9) Switch monitor on and verify that correct software version is displayed in startup screen.
10) Affix new S/W version label in area on right side panel.

Service Setup Instructions - Software Version VE0

1 Introduction

SC6002XL Series Portable Patient Monitors are shipped with software installed. Certain service password-protected functions in the monitor, however, need to be set for the specific customer site. The Service setup menu is accessed via the BioMed selection in the Monitor Setup.

2 Accessing Service Menu

Note: All field or menu items requiring a selection are written in *italic.*

Turn rotary knob to select a field or menu item or to change the default for a selected item. Press in on the knob to access a menu or menu item, or to set the new default for a selected item.

1) With monitor powered by ac power adapter, press and hold On/Off key in lower left corner of front panel for approximately 2 seconds.
2) After monitor has completed power-up sequence, press Main Screen key to remove "New Patient?" prompt.

   Note: If monitor alarms at any time during service setup, depress "All Alarms Off" button and continue with monitor configuration.

3 Service Setup Instructions

1) Press Menu button.
2) Select Monitor Setup → Monitor Options → Date & Time.
3) Set time and date as appropriate for customer site.

   Note: This must be performed if monitor is in standalone mode. If monitor is connected to the INFINITY NETWORK, time and date are set by the network.
4) Press Menu button.
5) At Main Menu, select *Monitor Setup → BioMed*.
6) Turn rotary knob to *375* and depress knob.
7) Select *Service*, turn rotary knob to *4712* and depress knob.
8) Select *Line Frequency*.
9) Set Line Freq. to frequency of power source at customer site.

   Note: An incorrect setting of line frequency can cause an artifact problem on the ECG waveform.
10) Select *Language* and change Language as appropriate for customer site, if required.

    Note: **Fre-NFC** selects French language and Homologation mode.

    French selects only the French language.

    When Language default is changed, display blanks while monitor recycles automatically.
11) After monitor completes power-up sequence, press Menu button.

    11.1) If Monitor is used in INFINITY NETWORK, select *Monitor Setup → Alarm Group* and set for alarm group number of monitoring unit.

    11.2) If Monitor is used in Standalone only, press Menu button, then select *Admit → Bed Label* and set bed label.

Note: This Bed Label is different from and has no connection to Bed Label set in CPS/IDS configuration in INFINITY NETWORK.

12) To enable a locked option (purchased separately), access *BioMed* menu as described in steps 4-6 and select *Locked Options*.

12.1) Set Lock numbers as indicated on option password certificate:

Lock 1 = ? Lock 2 = ? Lock 3 = ? Lock 4 = ?

12.2) Select corresponding option in Enable box, and press in on rotary knob.

Note: Display blanks while monitor resets and new option is activated.

13) For each additional locked option, reaccess Service menu and set lock numbers.

14) After monitor completes power-up sequence, press Main Screen button.

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For additional support, Siemens customers can contact their local Siemens Service Representative. Siemens Customer Support Engineers can contact the following as required:

In North and South America:

Siemens Medical Systems, Inc.

EM-PCS

Technical Service and Support

16 Electronics Avenue

Danvers, MA 01923 USA

Tel: (978) 907-7500

FAX (978) 907-7546

In Europe, Asia, Africa, Australia and New Zealand

Siemens -Elema AB

EM

Technical Service and Support

171 95 Solna, Sweden

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FAX: Int+46-8-986 662

SC 6002XL Patient Monitor Service Manual - CD-ROM
Order No. 72 61 105 E551U

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